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There was an interesting colloquy between Commissioner Lane and C. Haile, Vice-President and Traffic Manager of the Missouri, Kansas & Texas, at San Antonio, Tex., on November 20, during a hearing on the complaint of the Railroad Commission of Texas against the advance in class rates to the Southwest. Mr. Lane asked Mr. Haile if the order of the Interstate Commerce Commission reducing certain rates (on live stock) from that section had prompted the advance in class rates. Mr. Haile replied that "in a measure that is a fact." Mr. Lane retorted: "Your remedy is startling to me, that the theory of an increased rate is based to any extent upon the fact that the Interstate Commerce Commission has reduced other rates, because that, to my mind, practically nullifies the effect of our order, except so far as it brings about a new adjustment of rates and lessens the burden upon one particular commodity and increases the burden upon other commodities." The distinguished commissioner's own language seems more startling than Mr. Haile's. The main aim of the Interstate Commerce Law is to correct and prevent unfair discriminations between commodities, shippers and localities. The Commission can condemn a rate only upon the ground that it is extortionate *per se*, or that the average rate or earnings of the roads affected are too high, or that the rate reduced is too high as compared with other rates. If the Commission does not say that the rate reduced is extortionate *per se*, or that the average rate, or earnings, or both, of the roads affected, are excessive, have not the roads a right to assume that the rate is reduced because it is too high as compared with other rates? And if the Commission, in lowering certain rates to eliminate discriminations, makes the revenues of carriers less than their managements think they are entitled to, are not the managements justified in restoring earnings to a profitable basis by increasing other rates? Or, when the Commission reduces a rate or rates, must it be assumed that it thereby puts the seal of its approval upon all other existing rates and that the resulting adjustment does exact equity between all commodities, shippers and localities, is adapted to yield the roads the exact revenue to which they are entitled, and must not be disturbed by traffic managers for an indefinite period? The Commission cannot advance a rate; it can only fix maximum rates. If traffic managers are to be estopped not only from raising the rates the Commission has reduced, but also from raising the rates that it has not reduced, there soon will be nothing but reductions. The law does not deprive traffic managers of all discretion. It does not attribute to the Commission the omniscience requisite to make perfect adjustments of all rates throughout the country. Mr. Lane might reply that he was merely questioning the motive for the advance under consideration. But the Commission is not authorized to question the motives of traffic managers, but only to pass upon the reasonableness and fairness of the rates they make. Railway commissions generally tend to assume that readjustments of rates always should be downward and to look with suspicion on all advances, although nobody says that the average rate per ton per mile in the United States is excessive. For Commissioner Lane's ability and fairness of purpose we have great respect, but in this instance he unconsciously gave a good illustration of this unfair attitude of too many rate regulating authorities.

THE AUTOMOBILE IN RAILROAD RIVALRY.

One day last summer a railroad officer stationed himself for some twelve hours of daylight at a highway crossing of his line on a route leading to a series of summer shore resorts, none of them of large size. His viewpoint was some twelve miles from a New England city of considerable magnitude. He counted the passing automobiles for the day, and, making allowance roughly for mere pleasure travel, he estimated the loss for the day to his road in fares at $350. Again, in the lake region of Maine, there is a certain large summer hotel. Its record of automobiles that stopped and stayed, for times brief or long, during the three hot months of 1908 was a little more than 1,200 machines, and on one day in the season the score ran up to 50; and a very large part of that automobile business represented long-distance travel, a great part of it coming from Boston and some from New York. All summer resorts, of course, take up much the same story for the automobile in railroad rivalry and, in view of the character of its passengers, connote its double loss in the regular fare and the parlor car.

There are, of course, offsets. The Saratoga trunk, or eke the common trunk of the summer girl—or man—must perforce usually go otherwise than by automobile and generally by rail. Then again the automobile repeats the story of the trolleys. As parallels they divert steam business; as laterals they feed it. One man living at station A on a railroad takes his machine to a city, station B, say 50 miles away on the same line, and the railroad loses his fare. But another automobile lets its owner live up country ten or fifteen miles from station A or B and makes them accessible to him for railroad travel. The automobile, in practice, also often brings the express train station as near in point of time as the accommodation train station was before. The automobile, moreover, is the vehicle only for the open months and fair weather, not of chill autumn, cold winter and muddy spring, and, finally, there is the broad generalization that any agency of travel has its

residuum of travel for somebody else. The man who goes by automobile somewhere will often, as a sequel, take the railroad car to some other where.

But when all the additions and subtractions are reckoned up, in a computation necessarily vague, the balance is, of course, against the railroad, and it has its sharp suggestion of what may be called the side strokes by which the steam road has been hit in recent years. First came the parallel electric line; next the development of the long-distance telephone, and now the automobile. The future will tell whether the airship is to be a fourth. But the first two of these the railroad has overcome, the third is comparatively a minor factor, the fourth a commercial nebulosity as yet. And is not the enduring vitality of the railroad attested by the fact that it survives so well not only the blows of invention, but the ruder and, in some respects, more perilous shocks of state and federal attack?

THE NEW FEDERALISM AND THE RAILROADS.

The better part of a year has now passed since a letter from the highest federal authority to the Interstate Commerce Commission made a national and economic sensation. It was just then the depth of the panic period. Railroad earnings, gross and net, had run down with a rush and run down low, while railroad credit, measured by actual borrowing power and its rate of interest, was even lower relatively than earnings. It was at that juncture when the railroads were, perforce, considering reduction of wages that the letter referred to came forth from the White House. It declared in words that if any railroad corporation reduced wages that corporation must be investigated for any previous "misconduct." It said between the lines that in case of a strike due to wage reduction the influence and sympathies of federal authority would be thrown in favor of the strikers.

Such a missive from such a source in the days of Alexander Hamilton would have made that father of the old federalism stand aghast. Seen happily now in the past tense it may be cited as a superlative sample of the new federalism of which the railroads and other large fiscal interests have been the victims. It has not been a federalism that has rested upon constitutional interpretation old or recent except in the slightest dgeree. In even less degree has it rested on findings and mandates of the courts. Nor, as bearing on the railroads and as a broad fact, has it rested on higher economic laws and precedents, but it has been, in many cases, in violation of them. The new federalism, up to its present point, has been in fact merely a policy enforced by a person. One indeed goes not far astray if he calls it a personality rather than a policy. Certainly the policy would not have existed without the person. And in this country we have been witnessing for two or three years the situation, somewhat unique in a Republican form of government, of the polity of a great nation starting and developed from individual temperament.

It is in the nature of things that the new federalism beginning in a single man, active, impulsive, high in place and with extensive authority, should have a quick rise. It does not, in such a case, have to wait for the slow evolution of experience later hardening into law. It is executive rather than legislative or judicial. The single man can act while the law and its processes and ordinary governmental procedure must wait. Moreover, such a personified force has a special potentiality of its own. It is dramatic and charms the public eye. For the time being it seems to have a kind of "get there" quality. It is in the focus of the public vision. Above all it seems to have the power of creating a kind of atmosphere that minor units breathe in. It would be interesting if there could be reduced to statistics the exact volume of anti-railroad law-making in the 46 states of the union which during the year past has had its first inspiration, directly or indirectly, from the executive end of Pennsylvania avenue. And during the last six months the respiration in the nation and its states has not been decreased by the ardors and strenuosities of a presidential canvass.

But that canvass is now ended, a new central personality is to replace the old and the amplified federalism is to meet its real test. In its relation to the railroads it has to pass some searching ordeals. It must face, at the very outset, that law of reaction in public sentiment which inevitably follows radical action and radical state law making, both hasty. "Personality" and politics have had their fling and it is now the time of the law and the courts. There is one atmosphere when, blended with trade depression, are the smoky volleyings levelled at capital by federal and state authority—another atmosphere when a tired public welcomes the first signs of prosperity of which the bettered railroad earnings are the first index. In the coming few months or, more strictly speaking, in the six months that follow the fourth of next March, there will be many questions of acute railroad interest to be answered. How far will "my policy" square with the policy and methods of the presidential succession? How far will state anti-railroad legislation persist or react? By what processes, including possible raise of rates, will the railroads emerge from the encircling gloom of the current twelvemonth? In the answers to such questions of a pretty immediate future we shall doubtless see somewhat of the new federalism survive. But it will be a federalism tempered by law, its mushroom excrescences pruned away and, in its executive aspects, shaped by wiser methods and a cooler brain.

THE IMPROVED AIR-BRAKE.

We commence in this issue and will continue in several following numbers an abstract of a voluminous report, which illustrates in considerable detail the present highly developed state of the air-brake art, particularly as regards its operation. During the past summer the Westinghouse Air-Brake Company conducted an extensive series of tests on the Southern Pacific, which were calculated to demonstrate under conditions of actual service the many valuable features of the Improved Air-Brake Equipment for Freight and Passenger trains, as compared with the standard equipment now in general use. The tests were made under the joint direction of the Air-Brake Inspector of the Southern Pacific and the Resident Engineer of the Westinghouse Company, assisted by a staff of 20 men specially trained for the purpose.

The new air-brake was made necessary by the increasing length of freight trains to 80 or 100 cars, and by the difficulties and dangers attending the descent of heavy trains on steep mountain grades. For passenger service, faster schedules, requiring speeds of 70 and 80 miles per hour with heavy trains, have created conditions which demand safer control and shorter stops than can be obtained from the standard high-speed brake, notwithstanding its wonderful efficiency at ordinary speeds. The improved brake differs from the present standard equipment mainly in the functions which assist in approaching uniform and instantaneous application and release of all the brakes in a train, and these functions in the new equipment are known as "quick service," "uniform release" and "uniform recharge." The mechanism by which this is accomplished is fully illustrated under the title "Westinghouse E. T. Engine and Tender Equipment" in *The Railway Age*, February 2, 1906, page 203; and the K Triple is described in *The Railway Age*, March 30, 1906, page 600. The development of the K Triple through the various previous types is very fully described and illustrated in the *Railroad Gazette*, June 7, 1907, page 804, and June 14, 1907, page 862. The value of the new engine and tender equipment was quickly recognized, and it has been applied in large numbers on many railways during the past two years. It is

much simpler and has fewer parts than the old brake. It is particularly effective in removing the disturbance due to the mixture of locomotive and car brakes in the operation of standard equipment, and it produces a great improvement in handling trains without shock or danger of parting; and in passenger service especially smooth, accurate stops can be made with greater ease than was previously possible.

The various improvements which have been embodied in the K triple render it particularly valuable for long trains, as it assists in making the brake application by creating differentials of pressure locally on each car to assist in running the serial applications of the brakes through the train fast enough to avoid shocks. It was demonstrated that on an 80-car train the time required to run this serial application with the K triple was only half that with the standard triple. The "uniform release" feature was added to retard the escape of pressure from the brake cylinder on cars on the head end of the train until the pressure in the brake-pipe could be raised sufficiently on rear end to start release of the rear brakes; then, all brakes continuing to release together, zero pressure is reached simultaneously and shocks and break-in-twos are avoided. The "uniform recharge" feature of the K triple retards the recharge of auxiliary reservoirs on front cars sufficiently to compensate for the difference in time required to raise the pressure in the brake-pipe at the rear of a long train, the rear auxiliaries being the governing factors (especially on grade work) in securing uniform work by brakes throughout the train. This uniform recharge makes it easier to secure prompt rise of pressure in the brake-pipe on the rear end, thus insuring the movement of all triples to release position and avoiding stuck brakes and slid-flat wheels caused by non-release of brakes, and preventing break-in-twos which occur from attempts to start long freight trains with brakes applied on the rear cars. It has been demonstrated by careful investigation that fully 90 per cent. of all slid flat wheels in freight trains, with the old brake equipment, occur from non-release of brakes after a stop, rather than the supposed sliding during progress of the stop. The valuable features of the K triple are secured in a mechanism which can be readily added to the Standard Quick Action Triple already in use, and its action improves the operation of old triples when the new and old are mixed in the same train.

While the existence of all these improvements in engine and car brake equipment had been demonstrated on the testing rack, it seemed desirable to test this value in actual service, and under conditions where accurate measurements could be made of weights, time and speed, and we regard this work of so much importance in the interest of safer and more efficient railway operation that we are allotting a generous space to the publication of the admirable report of the experiments. The demonstrations of the serial action of the triple and other similar functions were made with train standing as this required principally time measurements.

Service demonstrations in operating heavy trains on 2 and 3.7 per cent. grades were made, by handling tonnage rated trains from Beaumont to Palm Springs, Siskiyou to Hornbrook, and Siskiyou to Ashland, on the Shasta division of the Southern Pacific, and they proved that a largely increased tonnage could be safely handled on these heavy grades by the use of the new brake equipment.

In handling a train of twenty 50-ton box cars, weighing 1,330 tons, down a grade 17 miles long, much of it 3.3 per cent., the remarkable performance was shown by handling 145,000 lbs. of load per brake, an increase of 80 per cent. over the standard rating with the same security and control. On the same mountain the standard tonnage rating is 1,325 tons, and 80,000 lbs. per brake. In the test the maximum tonnage was handled and 132,500 lbs. per brake, an increase of over 60 per cent. over the rating for standard equipment. On a 2 per cent. grade, from Beaumont to Palm Springs, the standard rating is 2,000 tons per train and 110,000 lbs. per brake; the new brakes handled 3,000 tons and 183,000 lbs. per brake, an increase of 50 per cent. in train tonnage and 65 per cent. in pounds per brake. This illustrates very forcibly the value of the new brake in accelerating the movement of traffic over congested mountain grades on important lines.

As to the reduction in length of stop, the diagrams show the remarkable results obtained by the use of the K triple. In handling an 80-car train at 30 miles per hour the stop was made in 1,700 ft. by a reduction of only 5 lbs. in train-pipe pressure, while the train with H triples ran 4,138 ft. The latter valve required a reduction of 20 lbs. in order to stop the train in 1,700 ft. The amount of air needed for the short stop by the K triple required 122 single strokes of the air pump, while the H triple required 474 single strokes. With 20-lb. brake-pipe reduction the 80-car train was stopped from 30 miles per hour in 1,089 ft. with the K triple while the H triple in standard equipment made the stop in 1,713 ft.

The improved passenger brake includes the features of the freight brake already described, but in addition it has a high emergency pressure feature, which maintains a uniform high pressure in the brake cylinder during the stop, so that a shorter and smoother stop can be made with the new "L" triple and 90-lb. brake-pipe pressure than with 110-lb. and the P standard triple. The new passenger equipment is provided with a safety valve for limiting pressure in service application. The tests with the passenger trains were made between Hayward and Niles, Cal., on comparatively level track. The improvements in the brake were intended to insure greater safety to the traveling public by stopping trains in the shortest possible distance. The gain over the high-speed brake in this respect is shown in the emergency stop from 70 miles per hour with eight cars, 90 lbs. brake-pipe pressure. The old equipment made the stop in 2,145 ft. and the new L equipment in 1,790 ft.—35,810,000 foot-pounds collision energy remaining in the train with the old equipment after the train with L equipment had stopped.

Tests with regular service application showed that with the same maximum cylinder pressures the stop from 60 miles per hour was made 200 ft. shorter by the improved equipment. This advantage is especially important in suburban traffic on short schedules, as the train is controlled more smoothly when passengers are standing in the rush hours, and a larger number of stops can be made on a shorter schedule than is possible with the standard equipment. The tests of the new passenger brake on 2 per cent. grade show the advantage of the graduated release and quick recharge features and demonstrate the possibility of handling heavy passenger trains on mountain grades without the use of retaining valves, as the control of brake cylinder pressure is placed in the hands of the engineer.

Other tests on 2 per cent. grade demonstrated the automatic safety reserve feature of the L triple. This provides that the stored volume of air can only be reduced to the point where the pressure in supplementary reservoirs prevents further release of the brakes, causing the pressure remaining in the brake cylinders to automatically stop the train, this being beyond the control of the engineer. This valuable feature of the new triple makes it impossible for a passenger train to run away on a grade.

It will be a great satisfaction to railway officers to know that the air-brake equipment is not only keeping up with the great advance which is being made in efficient railway operation but that it is now developed to a point where it actually improves conditions where long freight trains are handled and makes the operation of high-speed passenger trains smoother and safer. For these reasons the report of the remarkable air-brake demonstrations on the Southern Pacific must be regarded as the most important document relating to the mechanical operation of railways which has appeared in recent years.

NORTHERN PACIFIC AND CHICAGO, BURLINGTON & QUINCY.

The Northern Pacific controls the Chicago, Burlington & Quincy jointly with the Great Northern through the deposit of $107,613,000 stock of the Burlington as collateral for Northern Pacific-Great Northern joint bonds. As the accompanying map shows, the two roads are complementary rather than competing, and as the map also shows, although both are so-called Granger roads, the character of their mileage is quite different. The 5,633 miles operated by the Northern Pacific is largely main line through a comparatively thinly settled region, while the 3,236 miles operated by the Burlington is about half of it branch lines. It is to this difference in character of mileage to which one must look for an explanation of the fact that the Northern Pacific had an operating ratio of 62.40 per cent. last year while the Burlington's operating ratio was 74.52 per cent.

Unfortunately the annual reports of the two roads do not show a classification of freight by groups, so that it is only possible to make a guess at the character of tonnage carried. The Northern Pacific is the largest carrier of lumber in the United States, the tonnage of lumber being around 48 per cent. of the eastbound traffic. It handles merchandise westbound and grain eastbound. The Burlington's tonnage probably shows a large proportion of grain, and the commodities carried show a greater diversity than the Northern Pacific. The haul of lumber must be nearly the entire length of the main line of the Northern Pacific; moreover, the grain fields on its line are much further away from the markets than are the grain fields on the Burlington. This gave it last year an average haul of 329 miles, while the Burlington's average haul per ton was but 267 miles. Further than this, the Northern Pacific received 9 mills per ton per mile, while the Burlington received 8 mills per ton per mile. Again to show the difference in the character of haul on the two roads in another way, the freight density on the N. P. was 977,177 and on the Burlington 720,646.

When these points of difference are taken into consideration it is not surprising to find that the freight revenue in 1908 and 1907 of the Northern Pacific was $46,433,836 and $47,650,370 respectively, while the freight revenue in 1908 and 1907 on the Chicago, Burlington & Quincy was $53,036,306 and $56,516,689 respectively; this with an average mileage operated of 5,633 and 5,444 in the case of the former road and 9,236 and 9,122 miles in the case of the latter. In passenger revenue the Northern Pacific has an even greater advantage; earnings from this source were $18,133,239 and $16,320,861 in 1908 and 1907, while the Burlington earned $18,819,239 and $18,666,973 in 1908 and 1907. The average rate per passenger per mile on the Northern road was 2.258 cents in 1907 and 2.283 cents last year, while the Burlington earned 2.07 and 1.85 per passenger per mile.

With a net operating revenue of $4,668 per mile in the case of the Northern Pacific, and $2,166 in the case of the C., B. & Q., we ought to expect a much smaller capitalization per mile on the latter road. This turns out to be true. The Northern Pacific has capital stock amounting to $38,718 per mile of line operated last year and funded debt of $50,157 per mile. The Burlington has capital stock of $12,001 per mile and funded debt of $19,821. In arriving at these figures for the Northern Pacific the amount of capital stock outstanding, as shown on the balance sheet for June 30, 1908, was added to the paid in subscriptions on the new stock authorized but not yet issued. This is not an unfair comparison since the company is paying 7 per cent. on the paid in subscriptions to the new stock. Light is thrown on the capitalization of the two roads by the map. Branch lines are in general cheaper to build and to maintain than through trunk lines and where freight density is less, less equipment is needed per mile of line and a less expensive roadbed.

Taking the operating results for the two roads separately, the Northern Pacific had gross earnings of $68,876,409 as against $67,996,104 in 1907. This extremely good showing in revenues is partly offset by increased operating expenses, the total in 1908 being $39,865,033 as compared with $36,721,212; this is an increase of 8 per cent., being due largely to an increase of 30 per cent. in transportation expenses, the expenditure amounting to $20,743,429 last year. As no details of expenses are given it is impossible to compare specific items. Taking the totals, however, we find that maintenance of way cost $8,984,356 last year, a decrease of $347,040, or 4 per cent., and the charges for maintenance of equipment were $8,436,768, an increase of $2,657,822, or 46 per cent. The annual report states that this increase was due to monthly charges for depreciation of equipment made in accordance with the rules of the Interstate Commerce Commission.

The policy of the company towards the improvement of its property is well shown in the following comparison of business with expenditures for additions and betterments for the six fiscal years ended June 30, 1908.

Comparison of Business and Betterments.

	1903.	1904.	1905.	1906.	1907.	1908.
Freight earnings	$33,301,957.67	$32,998,921.50	$36,861,131.77	$44,041,466.51	$48,395,878.04	$46,423,836.33
Passenger earnings	10,595,447.40	11,105,752.94	11,335,852.07	14,368,221.39	16,924,187.71	18,550,504.70
Miscellaneous earnings	2,244,699.83	2,419,899.86	2,525,901.88	2,813,787.78	3,214,766.45	3,902,069.00
Total earnings	$46,142,104.90	$46,524,574.30	$50,722,885.72	$61,223,475.68	$68,534,832.20	*$68,876,410.03
Maintenance of way	$7,117,335.24	$6,645,953.25	$7,345,820.70	$7,493,729.90	$9,145,546.92	$8,984,355.86
Maintenance of equipment	3,887,807.33	4,112,370.73	5,053,586.34	5,944,119.08	5,542,208.53	8,436,766.89
Conducting transportation	11,384,779.54	11,721,605.58	12,565,739.81	15,673,348.43	20,887,230.05	20,743,429.22
General expenses	1,642,170.81	1,754,613.13	1,843,611.69	1,984,234.90	2,089,331.17	1,700,481.33
Total	$24,032,092.92	$24,234,542.69	$26,808,758.54	$31,095,432.31	$37,664,316.67	$39,865,033.30
Net earnings	$22,110,011.98	$22,290,031.61	$23,914,127.18	$30,128,043.37	$30,870,515.53	$29,011,376.73
Freight train miles	10,270,223	10,085,489	11,045,432	12,248,582	12,781,289	11,115,420
Passenger train miles	6,773,831	6,643,836	6,786,799	8,057,721	8,922,675	9,066,484
Mixed train miles	822,187	785,419	849,178	849,035	750,859	859,094
Total train miles	17,866,241	17,514,744	18,681,409	21,155,338	22,454,823	21,040,998
Tons 1 mile—commercial	3,815,942,943	3,685,672,022	4,359,664,201	5,245,260,080	5,504,444,098	5,156,378,369
Tons 1 mile—company	646,209,303	694,778,562	729,735,678	881,254,038	1,156,210,616	1,038,983,533
Total tons 1 mile	4,462,152,246	4,380,450,584	5,089,399,879	6,126,514,118	6,660,654,714	6,195,361,902
Passengers carried	4,917,814	5,119,539	5,142,891	5,920,280	6,953,424	7,880,333
Passengers carried one mile	473,754,272	483,650,266	488,522,472	659,050,227	722,745,259	794,351,948
Spent for additions to and betterments of the property (excl. charges to operat'g exp)	$10,336,327.12	$8,086,651.27	$6,943,552.60	$6,940,898.03	$21,945,582.17	$24,302,672.31

*Includes "Outside Operations."

There were 59 more locomotives on the active list on June 30, 1908, than on the same date a year previous, and the number of passenger cars on the road increased by 30, being 923 on June 30, 1908. There were 42,171 freight cars in service in 1908, a decrease of 149 from the previous year. But in addition to the equipment shown on hand June 30, 1908, there are due and have been or will be received in a short time 30 passenger cars and 1,013 freight cars.

The balance sheet shows cash on hand amounting to $34,900,795 as against $11,899,998. In the previous year $95,000,000 additional capital stock was authorized and $93,000,000 was offered to stockholders at par. The large increase in cash on hand this year comes from payments on the subscriptions for this stock, the payments totalling $62,881,836 on June 30, 1908. Since the annual report was published, and within the last two weeks, an extra dividend of $11.26 per share was declared on the old capital stock, the newly authorized stock not participating in this dividend. The dividend was declared out of the profits of a subsidiary company, from the accumulated surplus of a number of years.

The annual report of the Chicago, Burlington & Quincy gives such meagre details of operation that in any year it is not a great help in a study of the property, but the report for 1908 in its changed form makes comparison with the previous year actually misleading. The report of the general auditor this year gives only the figures, balance sheet, income account, and so on, of the Chicago, Burlington & Quincy Railroad, while his report the previous year gave a composite balance sheet and accounts made up of the figures for the Chicago, Burlington & Quincy Railroad and Railway Companies. The Railway Company ceased to operate the road on July 1, 1907. More than this, the Interstate Commerce Commission prescribed forms of accounts effective July 1, 1907, necessitating changes in classification and names of accounts, thus preventing a correct comparison of figures in detail for the two years. Reclassification of figures for year ended June 30, 1907, has not been attempted. No matter how little sympathy we may have with the theoretical and elaborate classification prescribed by the Interstate Commerce Commission, it is doubtful whether a company does not owe it to its stockholders to at least make the attempt to reclassify its figures, so that a stockholder may make a more or less accurate comparison of the management of his road in the year just ended with the previous year.

In November, 1907, the Sioux City & Western, from Sioux City, Neb., to Ashland, with a branch to O'Neill, 229 miles, was purchased, giving the Burlington the haul of grain from the Missouri Valley to Minneapolis in connection with the Great Northern, and return haul from Minneapolis of flour for Chicago. The portion of the S. C. & W. from Sioux City to Ashland was shown as operated by the Burlington on its official map of June 30, 1907, but the branch to O'Neill was operated by the Great Northern.

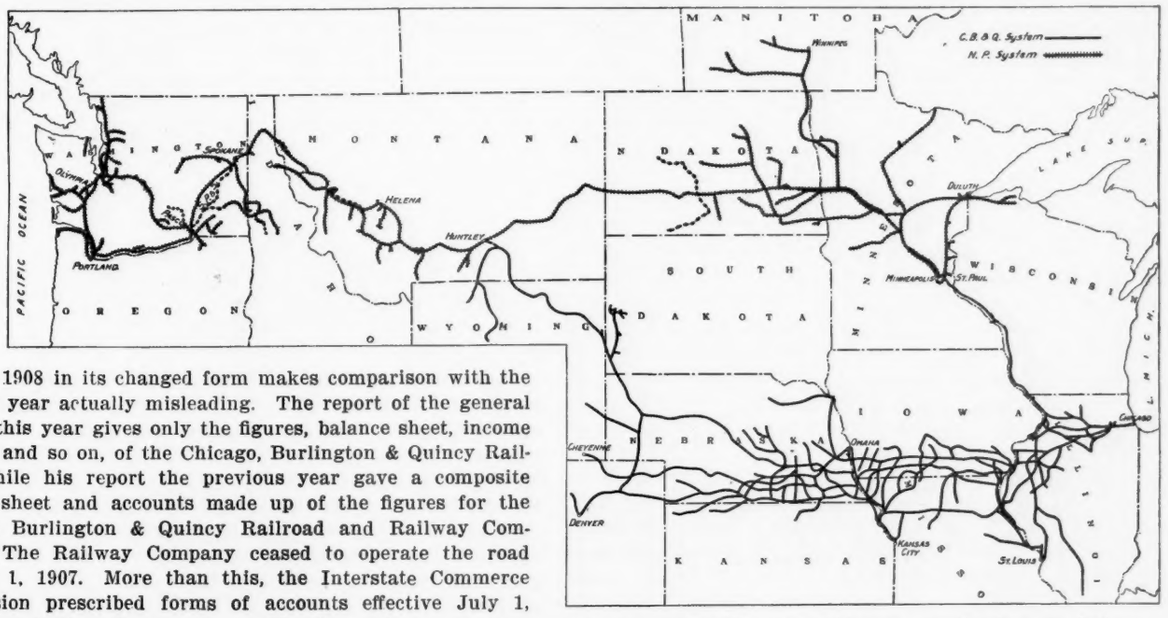
The greatest savings in expenses made by the Burlington were in the items, maintenance of equipment, which decreased from $14,725,632 to $12,501,461 last year, and in general expenses, which decreased from $4,509,217 to $1,817,836. Although the total number of tons of revenue freight carried one mile decreased by about 7 per cent., the expenses for conducting transportation were slightly higher last year than in 1907, due probably in part to an increase of 13 per cent. in the number of passengers carried one mile.

There were added to the equipment 99 locomotives, 6 passenger cars, 2,000 coal cars, and 304 other freight cars.

Both the Northern Pacific and the Burlington were made the object of the general outcry against railroads by the state commissions. The commission in Minnesota fixed a 2-cent-a-mile passenger rate, and the Northern Pacific was restrained from raising its rates on lumber from the Pacific coast; this later by the Interstate Commerce Commission. North Dakota also passed a fare law reducing passenger rates from 3 cents to 2½ cents a mile. These rules are now in effect but are being fought in the courts by the railroad companies.

The low capitalization of the Burlington and the great earning power of the Northern Pacific, together with the growth of the country through which they run, give the combined properties an outlook for future development equaled by few of the great roads in this country.

The following table shows the results of operation of the



Northern Pacific and Chicago, Burlington & Quincy.

Northern Pacific for the last two years, the figures for 1907 having been rearranged to correspond to the classification prescribed by the Interstate Commission Commission:

	1908.	1907.
Average miles operated	5,633	5,444
Freight revenue	$46,423,836	$47,650,370
Passenger revenue	18,133,239	16,320,861
Total operating revenues	68,876,410	67,996,204
Maint. way and structures.	8,984,356	9,331,396
Maint. of equipment	8,436,767	5,778,945
Traffic	808,448	734,654
Transportation	20,743,429	19,901,788
Total operating expenses	39,865,033	36,721,212
Taxes	2,717,486	2,398,719
Net revenue	26,293,891	28,876,273
Gross income	30,297,889	31,753,072
Net income	19,893,068	23,473,929
Dividends	10,850,000	10,850,000
*Depreciation and ins. fund.	2,784,950	5,926,753
Surplus	6,258,118	6,697,176

*In 1908 there was no charge for depreciation, that account coming under operating expenses, while in 1907 nothing was appropriated for insurance fund.

The following table shows the results of operation of the Burlington for the last two years:

	1908.	1907.
Average miles operated	9,236	9,122
Freight revenue	$53,036,306	$56,516,689
Passenger revenue	18,819,239	18,666,973
Total operating revenue	78,474,259	82,473,251
Maint. way and structures.	14,603,477	14,445,867
Maint. of equipment	12,501,461	14,725,632
Traffic	1,555,180	.....
Transportation	25,507,271	25,224,272
Total operating expenses	55,985,225	58,904,988
Taxes	2,484,031	2,838,800
Net revenue	20,005,002	20,729,464
Gross income	19,758,390	21,172,726
Net income	12,115,488	13,155,207
Dividends	8,867,128	7,758,737
Betterments	3,225,994	.....
Surplus	22,367	5,396,470

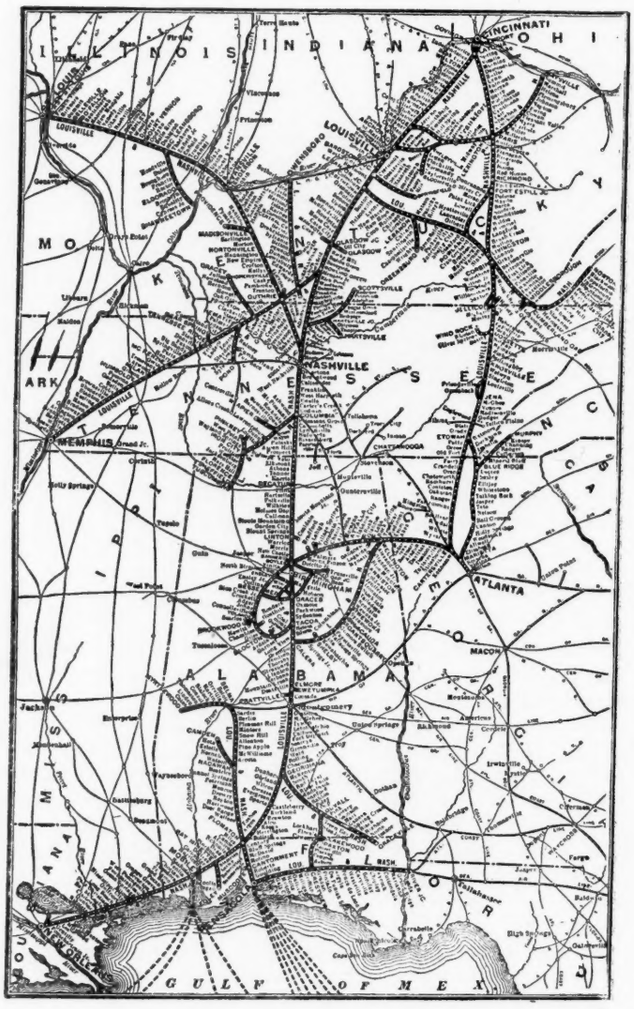
LOUISVILLE & NASHVILLE.

The recent declaration of an extra dividend by the Northern Pacific from the profits of a subsidiary, the financial condition of which had been a mystery to outsiders, brings to mind the declaration early in the present calendar year of a dividend of 1 per cent. on Louisville & Nashville stock, payable in stock at par of the Louisville Property Co. At the time this dividend was declared, stockholders of the Louisville & Nashville and the banking public were much interested to learn for the first time the existence of $600,000 stock of the Louisville Property Co.— that is about all they did learn. An official circular was forthcoming after a good deal of inquiry which stated that the Property Company had heretofore served as a holding company for various real and personal properties, including coal lands * * * which it was not desired to subject to the liens of the Louisville & Nashville mortgages, and the circular went on to say: "Complete exhibit of the Louisville Property Company's financial condition will be furnished stockholders in the next annual report." The property Company is mentioned in a few places in the report. The Louisville & Nashville holds in its treasury $2,050,591 gold bonds of the Property Company. It has made $51,068 profit arising from the operation of the Property Company on capital furnished by the Louisville & Nashville, and, as before mentioned, has paid to its stockholders $600,000 stock of the Louisville Property Co. as an extra dividend. This explains the relation between the Louisville Property Co. and the Louisville & Nashville, but it leaves wholly unexplained the financial condition of the Louisville Property Co. What, may we ask, are the bonds secured on? What are the Property Company's assets and liabilities?

The payment of extra dividends on the Northern Pacific did not reduce its very abundant supply of cash, nor did the payment of the scrip dividend by the Louisville & Nashville reduce its cash. But the Nashville's cash is far from abundant. It would appear from the balance sheet that some time in the not far future the company will have to dispose of some of its securities to replenish its working capital. There are shown total cash assets, exclusive of remittances in transit, of $3,643,772 on June 30, 1908, and $8,201,192 cash assets on June 30, 1907. The decrease in cash on hand, the report says, is accounted for by large expenditures for second track and reduction of grades, redemption of bonds, additional advances to subsidiary companies, and other authorized expenditures, for a material part of which the company's treasury will eventually receive bonds. There were, however, sold $3,000,000 unified 50-year 4 per cent. bonds sold early in 1908, which netted the company $2,815,300. On the other side there are pay-rolls audited and unpaid of $1,778,881, vouchers and accounts payable of $1,047,272, and interest and rental due and unpaid of $1,374,799. Beside this the company has outstanding $6,500,000 three-year 5 per cent. unsecured notes due March 1, 1910, which were sold in 1907 at a discount. The Nashville's lack of cash, however, is not serious, since its credit is excellent, and it has bonds in its treasury which are selling on the stock exchange at fair prices. Among other securities in the treasury are $11,669,000 Atlantic, Knoxville & Cincinnati division 4 per cent. bonds, $3,470,000 unified 50-year 4 per cent. mortgage bonds, and the previously mentioned Louisville Property bonds. The total amount of Louisville & Nashville issues in the treasury aggregate $16,408,000.

The company's road, lying as it does in an industrial section of the country and hauling freight, a large proportion of which is probably iron and steel products and ores, was hard hit in its earnings by the general business depression. This is shown by a total operating revenue of but $44,620,281 last year as compared with an operating revenue of $48,263,945 in 1907. As might have been expected, the greatest decrease was in revenue from freight, which amounted to $31,334,941 last year as compared with $34,971,261 in the previous year. Passenger revenue was slightly greater than in 1907 and amounted to $12,725,556. The earnings per passenger per mile amounted to 2.379 cents as against 2.347 cents in 1907, and the earnings per ton per mile were 0.779 cents last year and 0.796 cents in the previous year.

Operating expenses were reduced, but not in proportion to the reduction in traffic. The expenses amounted to $33,594,291 last year as against $35,781,303. The saving came from a reduction of a little less than a million dollars in transportation expenses, which amounted to but $16,196,685 last year, and a reduction in the cost of maintenance of way, the sum spent for this purpose being $6,291,108 last year as against $8,065,898 in the previous year. No attempt was made to cut the very liberal maintenance of equipment expenses, and, as a matter of fact, no reduction was made in maintenance of way and structures since $1,883,924 was spent for improvements in 1907 and charged to maintenance of way and structures; while $1,690,468 was spent for additions and betterments in 1908 and charged directly to income account. Excluding these sums charged for improvements in 1907 and betterments in 1908, there was spent for maintenance of way and structures proper $1,447 per mile last year as against $1,423 in 1907.



Louisville & Nashville.

The unit costs of maintenance of equipment for the two years are not probably absolutely comparable, but the sum spent for repairs of locomotives per locomotive was $3,256 in 1908 as against $3,080 in the previous year; repairs of passenger cars, per car, cost $1,016 in 1908 and $924 in 1907; repairs of freight cars, per car, $73 in 1908 and $67 in 1907. These are very large

sums, especially when it is remembered that the company has a great deal of equipment as compared with other roads of its mileage and traffic density, and that the equipment was increased during the year by the addition of 31 locomotives, 13 passenger cars and 1,061 freight cars, bringing the total equipment owned last year up to 896 locomotives, 572 passenger cars and 40,589 freight cars.

Unfortunately the annual report does not give any classification of freight by commodities. It would be particularly interesting in the case of the Nashville to compare the tonnage of the different classes of freight with the tonnage carried by the Southern Railway, for instance. One might guess from the location of the two roads that the Southern shows a more diversified tonnage than would the Nashville if its figures were given out, and that possibly the Nashville is more dependent on iron and steel industries for traffic than is the Southern. As often as the two roads have been compared (generally much to the advantage of the Nashville), seldom, if ever, has it been pointed out that while the Nashville is largely main line and needs to spend more for maintenance, the Southern is a tangle of branches, many of which probably have very light traffic and need comparatively inexpensive repairs.

Traffic statistics show that the number of passengers carried amounted to 10,641,341 last year as against 10,908,541 in the previous year; while each passenger was carried on an average 41.83 miles as against 39.68 miles, an increase of over 5 per cent. in the average haul per passenger. The number of tons of freight carried totaled 23,256,502 last year as compared with 26,093,798 in the previous year, and the average haul was 172.87 miles last year as compared with 168.45 miles in 1907. Most surprising of these traffic statistics is the showing of empty car mileage, which amounted to 96,345,335 miles last year, a decrease of 7.80 per cent. from the previous year. Other roads whose annual reports we have reviewed have shown substantial increases in empty car mileage almost without exception. The average train load was 233.60 tons in the fiscal year 1908 as against 230.95 in the previous year.

Like other southern roads, the Louisville & Nashville is having its troubles with state commissions. It has, however, made a vigorous fight, and has obtained injunctions against the enforcement of state commission rulings reducing fares and rates until such time as the rulings of commissions could be reviewed by impartial judges, and has not, therefore, suffered as yet to any great extent from the hostile legislation except in the harm that has been done to its credit. During the year dividends were reduced from a 6 per cent. annual rate to a 5 per cent. rate 5½ per cent. having been paid in the past fiscal year. This is in accordance with conservative management, and together with the large maintenance expenditures, puts the road in a very strong position for the coming year.

The following table shows the results of operation for the last two years. The figures, however, are not directly comparable since the figures for 1907 have not been rearranged to correspond to the classification prescribed by the Interstate Commerce Commission:

	1908.	1907.
Average miles operated	4,348	4,306
Freight revenue	$31,334,941	$34,971,261
Passenger revenue	12,725,556	12,307,434
Total operating revenue	44,620,281	48,263,945
Maint. of way and structures.	6,291,108	8,065,898
Maintenance of equipment	9,020,127	8,709,611
Traffic	1,056,279	963,227
Transportation	16,196,685	17,009,121
Total operating expenses	33,594,291	35,781,303
Taxes	1,393,760	1,365,254
Net revenue	9,632,230	12,117,388
Gross income	10,952,898	14,044,398
Net income	2,824,456	6,450,522
Dividends	3,300,000	3,600,000
Surplus	*45,544	2,950,522

*Deficit in 1908.

NEW PUBLICATIONS.

Bulletins of the Engineering Experiment Station. Nos. 9 to 17. University of Illinois. Volume II.

This book is a bound volume of the bulletins that have been issued from time to time by the University of Illinois on the various topics that have been made the subject of investigation, some of which have already been reviewed in the *Railroad Gazette* and the *Railway Age*. The papers include a report on the Extension of the Decimal System of Classification for Libraries; Prof. Talbot's paper on Tests of Concrete Columns; Effect of Scale on Boiler Tubes; Tests of Reinforced Concrete T and ordinary Beams; A Study of Roof Trusses; a report on the Weathering of Coal, and Prof. Breckenridge's report on How to Burn Illinois Coal without Smoke.

Letters to the Editor.

THE BALDWIN SMOKEBOX SUPERHEATER.

Philadelphia, November 20, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

Permit me to point out an inaccuracy in your article on the Baldwin smokebox superheater, published November 20, on page 1402. Under (3) you say: "The total economy in water in the superheating steam locomotive amounts to 15 to 20 per cent." These figures should be 8 to 12 per cent.

JOHN W. CONVERSE.

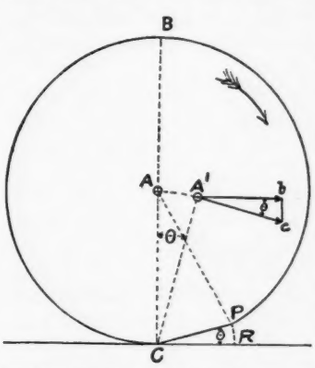
FLAT SPOTS ON CAR WHEELS.

Pittsburgh, Pa., November 30, 1908.

TO THE EDITOR OF THE RAILROAD AGE GAZETTE:

In the article on "Flat Spots on Car Wheels," by Prof. Chas. H. Benjamin, published in your issue of November 27, 1908, a mathematical formula, as developed by Prof. E. L. Hancock, of Purdue University ,is given for the determination of the energy of impact of a flat wheel upon the rail. This formula is then applied in computing energy of impact in foot-pounds of a 2.5 in. flat spot on a 33-in. diameter wheel for cases where speed of train is between 30 and 60 miles per hour. I wish to call attention to the fact that this formula is inapplicable for these speeds.

In the derivation of Prof. Hancock's formula, it is assured that when the flat spot is just beginning its contact with the rail, as shown in the figure, the wheel is turning about the point C and *will so turn* until P reaches R. At this instant, center of car wheel will have moved from A to A¹. Now it will be seen from the figure that the center of car wheel, in moving from A to A¹, will have traveled horizontally a distance equal to half the length of flat spot, and fallen vertically a distance equal to ¼ P R (approximately).



This assumption holds true only for speeds from zero up to a certain speed X. The value of this speed X must be such that, acting in combination with the force of gravity, it will just allow center of wheel to fall vertically, an amount equal to ¼ P R in the time it takes center of wheel to travel horizontally, a distance equal to half the length of flat spot. For all speeds greater than X, the center of the wheel will fall less than ¼ P R before the edge P of the flat spot comes

in contact with the rail. Therefore, at speeds greater than X the wheel will not turn about point C until P reaches R, but will leave the rail before this latter point strikes the rail, and for a brief interval of time no point on the wheel tread is in contact with the rail. Consequently, Prof. Hancock's formula is incorrect for all speeds greater than X.

The computation of this speed X will now be given, taking diameter of wheel as 33 in. and length of flat spot as 2.5 in.

Distance center of wheel falls $= \frac{P\ R}{4} = \frac{2}{\frac{2.5}{33 \times 4}} = \frac{6.25}{132} =$ .047 in. Let X = speed in feet per second of train when center of wheel falls .047 in. in traveling horizontally, 1.25 in.

For falling bodies $t = \frac{2\ h}{9}$, then time required for wheel to fall .047 in. $= \frac{2 \times .047}{32.2 \times 12} = \sqrt{.000243} = .0156$ sec.

Speed of train $X = \frac{\text{distance}}{\text{time}} = \frac{1.25}{12 \times .0156} = 6.68$ ft. per second.

Speed X in miles per hour $= \frac{15}{22} \times 6.68 = 4.55$.

Prof. Hancock's formula does not, therefore, apply to speeds greater than 4.55 miles per hour.

Prof. Benjamin in his article mentions the fact that in the mathematical treatment, the possible bounding of the wheel from one corner of flat spot to the other without touching the rail at high speeds has been neglected. Considering the fact that action of this nature actually occurs at speeds as low as five miles per hour, it seems reasonable to infer that neglecting this action entirely at speeds from 30 to 60 miles per hour will very appreciably affect the results. The absolute value of the results obtained by applying a mathematical formula to conditions so far outside its limitations is questioned.

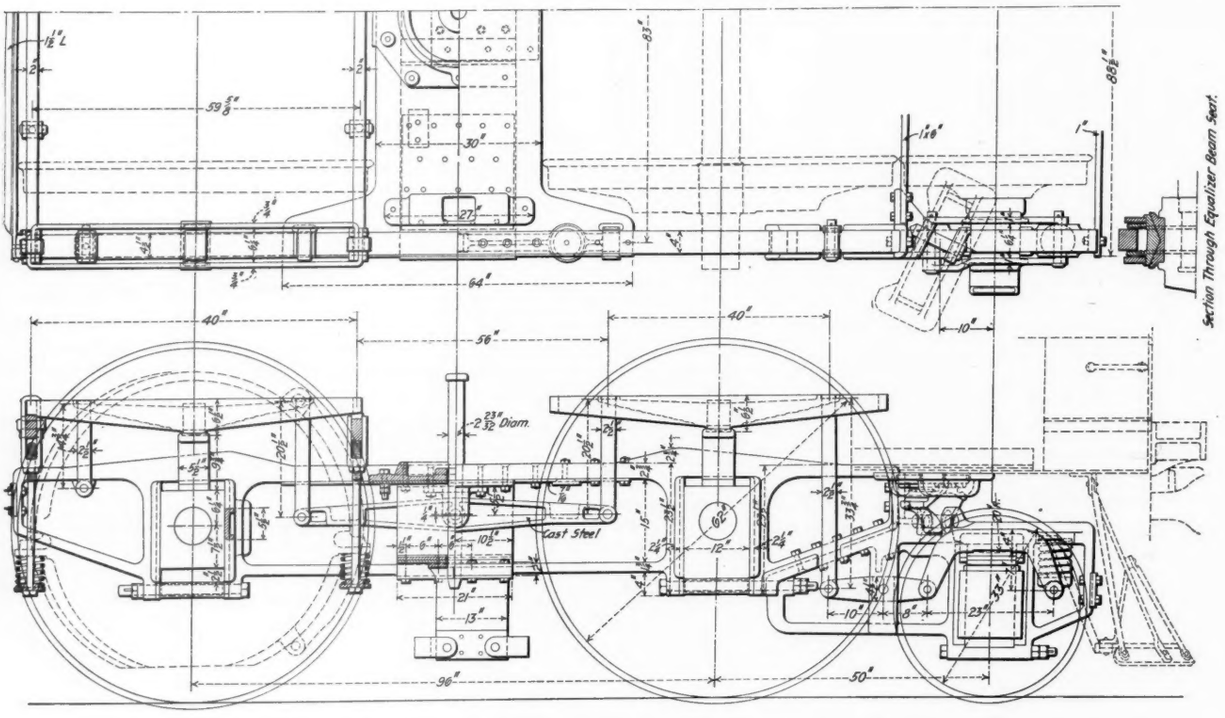
This formula is, nevertheless, thought to be valuable as a means of determining the comparative effects upon the rail of flat spots of different lengths on car wheels.

E. E. STETSON.

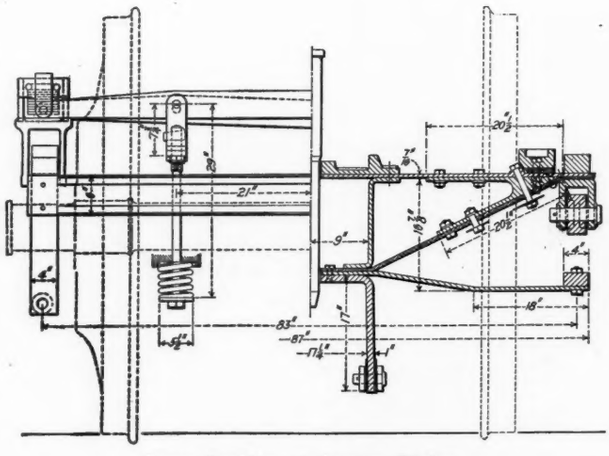
Contributed Papers.

CHANGE IN WHEEL ARRANGEMENT OF NEW HAVEN ELECTRIC LOCOMOTIVES.

It will be remembered that the electric locomotives of the New York, New Haven & Hartford had a very simple driving-wheel arrangement, consisting of two pairs of 4-wheel trucks and no engine trucks. While the extended tests of these locomotives by the Westinghouse Company, before they were delivered to the New Haven, indicated that this wheel arrangement would be safe and satisfactory at high speeds, later experience with the engines has led to a modification of the wheel arrangement, which is indicated in the drawing here shown.



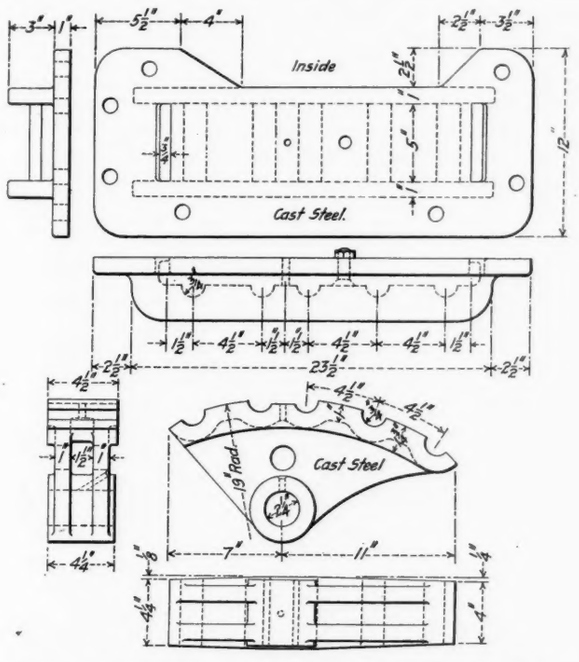
Plan Showing Addition of Pony Wheels; New Haven Electric Locomotives.



Cross Section at Center Plates.

On account of the addition of electrical apparatus the weights on the driving wheels were regarded as excessive, and in the finished locomotives the weights were much higher than

those originally estimated. After the engines had been in service some time and the bearings were all slightly worn, they appeared to be almost too flexible, and when running on a tangent at high speed the nosing effect was found to be objectionable. In order to reduce to some extent the weight on the wheels and also steady the drivers and prevent nosing, it was decided to add a pair of 33 in. pony wheels in a rigid frame bolted to the front end of each main frame. With the addition of one pair of truck wheels front and back of each locomotive, the distribution of weights is as follows: On each



Side Bearing, Cam and Plate, Over Guiding Wheels.

of the two pairs of pony wheels, 25,000 lbs.; on each of the four pairs of driving wheels, 38,500 lbs. This makes the total weights on the pony wheels 50,000 lbs. and the total weight on the driving wheels 154,000 lbs., making the total weight of the engine 204,000 lbs.

The journals of the pony axles are 5½ x 10 in. The weight on the pony wheels is equalized with a spring on the front driver and there is a helical spring at the extreme end of the pony equalizers. The bearing for these equalizers is V-shaped and is shown in section at the extreme right of the drawing. The side bearing for the pony frame consists of a cam which has a pivot bearing on the pony frame and a plate on the main frame, this latter having semi-circular teeth which mesh into the cam on the pony frame. The eccentricity of this cam tends to restrain the pony wheels from lateral movement, and the weight on the cam tends to restore the wheels to their normal position on straight track.

France has few undeveloped resources, such as mines, etc., which, as in times of prosperity, greatly enlarge the traffic of the railroads of this country, and also in Germany, where the great coal and iron industries have grown very rapidly for 20 years or so: and France has a stationary population; but its traffic grows at a satisfactory rate under the circumstances. From 1901 to 1907 the earnings of the French railroads increased 16 per cent., and from 1904 to 1907, 12 per cent.; the growth of traffic being exceptionally rapid after 1903, as in other countries, and largely affected by the prosperity of other countries. But the growth of expenses has been more rapid than that of earnings, and from 1906 to 1907, an increase of 48 million francs in earnings was accompanied by an increase of 79 millions in working expenses.

TRAIN ACCIDENTS IN OCTOBER.[1]

Following is a list of the most notable train accidents that occurred on the railroads of the United States in the month of October, 1908. The monthly records are intended to include usually only those accidents which result in fatal injury to a passenger or an employee or which are of special interest to operating officers. They are based on accounts published in local daily newspapers, except in the cases of accidents of such magnitude that it seems proper to write to the railway manager for details of for confirmation.

TRAIN ACCIDENTS IN THE UNITED STATES IN OCTOBER, 1908.

Collisions.

Date.	Road.	Place.	Kind of Accident.	Kind of Train.	No. persons reported Kil'd.	Inj'd.
†1.	Tol. & Ohio Cen.	Sugar Ridge.	rc.	P. & Ft.	4	8
*†4.	Chic. & N.-W.	Parker.	rc.	Ft. & Ft.	1	0
6.	Pennsylvania	Lancaster.	rc.	Ft. & Ft.	2	6
8.	C., R. I. & Pac.	Yukon.	rc.	P. & Ft.	0	31
13.	N. Y. Central.	Buffalo.	xc.	P. & Ft.	1	0
14.	Den. & Rio G.	Oliver.	bc.	Ft. & Ft.	2	1
16.	Dul., S. S. & A.	Greenwood.	bc.	P. & Ft.	1	1
19.	A., T. & S Fe.	Braddock.	bc.	P. & Ft.	1	22
†20.	Oregon S. L.	Boise.	bc.	P. & P.	1	2

Derailments.

Date.	Road.	Place.	Cause of derlmt.	Kind of train.	No. persons reported Kil'd.	Inj'd.
1.	Pennsylvania	Fort Hill.	boiler.	Ft.	1	2
2.	St.L., I. M. & S.	St. Louis.	unx.	Ft.	1	0
7.	Great Northern.	Marias.	d.track.	Pass.	2	1
*14.	Mo. Pacific.	Shannon, Kan.	b. bridge.	Pass.	0	2
*†16.	Det. & Mac.	Metz.	fire.	Ft.	18	..
19.	Union Pacific.	Lone Tree.	wind.	Ft.	6	20
28.	C.,St.P.,M. & O.	Kempton.	malice.	Pass.	0	11

Other Accidents.

Date.	Road.	Place.	Cause of accident.	Kind of train.	No. persons reported Kil'd.	Inj'd.
13.	Southern	Mayo, Va.	boiler.	Ft.	1	2
28.	L. S. & M. S.	Elyria.	boiler.	Ft.	1	2

The most notable collisions in the foregoing list are those at Sugar Ridge, Ohio, on the first; Greenwood, Mich., (16th) and Braddock, Kan., (19th); and the most notable derailments were those at Metz, Mich., (16th) and Lone Tree, Wy. (19th).

The rear collision at Sugar Ridge, Ohio, wrecked the two rear cars of an excursion passenger train and badly damaged two others. Four passengers in the rear car were killed, and seven other passengers and one trainman were injured. The passenger train had just stopped at the station when it was run into at the rear by a following freight. The flagman had not gone back or had not gone far enough, and the freight was approaching the station at excessive speed.

The Greenwood collision was due to the fault of the conductor of the passenger train, who mistook the identity of a train standing on a side track. The collision at Braddock is reported to have been due to the error of the men in charge of the westbound train in running past a block signal set against it.

The distressing disaster at Metz was due to forest fires, the train destroyed being loaded with refugees endeavoring to escape with their lives. This accident was reported in the *Railroad Age Gazette* October 23, page 1,211.

The derailment at Lone Tree was due to a terrific mountain gale which lifted a caboose occupied by the laborers of a work train and tore it from its train. It was thrown over a bank and fell about 30 ft., with all of its 40 occupants.

Of the 11 serious street car accidents reported in the newspapers in October two resulted fatally—those at Haverhill, Mass., and Kansas City, Mo.

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[1] Abbreviations and marks used in Accident List:
rc, Rear collision——bc, Butting collision——xc, other collisions——b, Broken——d, Defective——unf, Unforeseen obstruction——unx, unexplained——derail, Open derailing switch——ms, Misplaced switch——acc. obst., Accidental obstruction——malice, Malicious obstruction of track, etc.——boiler, Explosion of boiler of locomotive on road——fire, Cars burned while running——P., or Pass., passenger train——F., or Ft., freight train (includes empty engines, work trains, etc.)——Asterisk, Wreck wholly or partly destroyed by fire——Dagger, One or more passengers killed.

ELECTRIFICATION OF MELBOURNE SUBURBAN LINES.*

BY CHARLES H. MERZ, M.INST.C.E.

V.

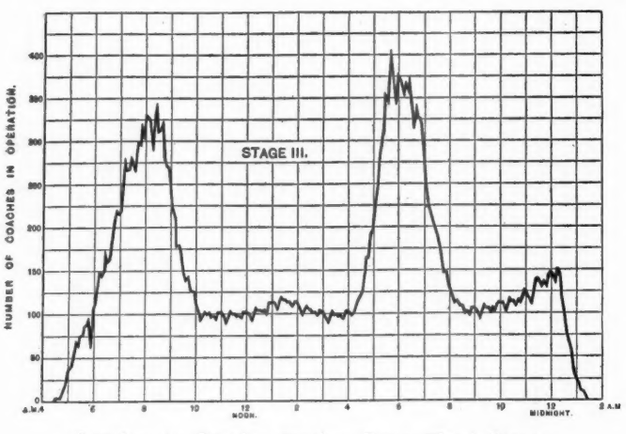
Table I. shows the train and ton-miles which would be run per annum with the proposed electric service, as compared with the steam service.

TABLE I.—*Comparison of Annual Mileages with the* 1906 *and Proposed* 1912 *Services.*

	Port Melbourne and St. Kilda Branches		Stage I.		Stage II.		Stage III.	
	1906 steam service	1912 electric service.	1906 steam service	1912 electric service.	1906 steam service	1912 electric service.	1906 steam service	1912 electric service.
Train-miles per annum in millions (including waste mileage)*.....	0.255	0.334	0.965	1.458	1.807	2.923	2.795	4.780
Ton-miles per annum in millions (including waste mileage*	43.40	36.96	179.14	203.00	323.30	391.90	494.15	608.14

*By waste mileage is meant the miles that would have to be run to give the proposed service over and above the miles obtained directly from the time table. It includes all mileage run in shunting and making up trains and in taking trains to and from the car sheds both in the morning and in the evening and at times when the service has to be varied.

The increase in train-mileage, compared with 1906, which is a measure of the improvement in the frequency of the



Coaches in Service During Day; Final Stage.

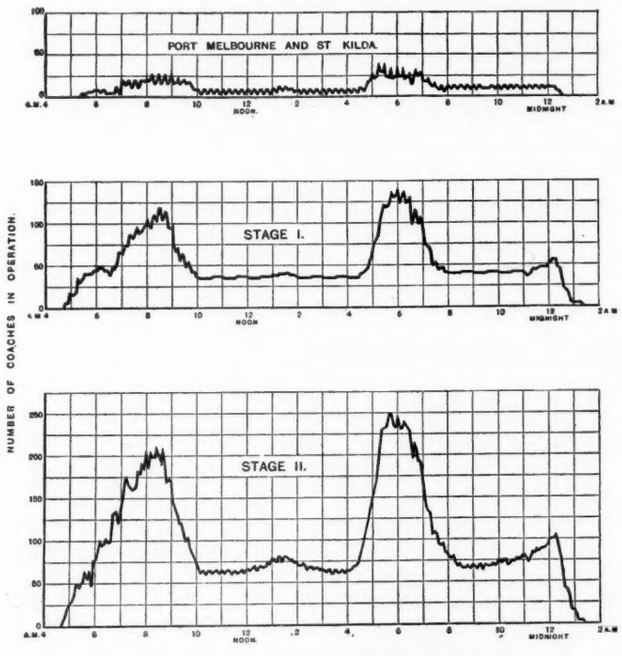
service, is 71 per cent. The increase in ton-mileage is, however, only 23 per cent., owing to the size of train, being more closely proportioned to the traffic variations throughout the day and the saving in locomotive weight with the multiple-unit system of train operation.

A chart shows for the complete scheme and on the basis of the electric service proposed the number of coaches in operation throughout the twenty-four hours for an ordinary week day. Another gives the same information for the earlier stages of the work. These curves, in conjunction with the speed time curves which I have had drawn, have enabled me to calculate the amount of power required by the railroad system.

We are now in a position to make accurate estimates of the capital cost and operating expenses with different systems of electric traction, and it will, therefore, be convenient, I think, to deal at once with the system of electric traction recommended. After having done this I will deal, in the order named, with the power station and the supply of power to the railroad system, the track equipment and the rolling stock and the electrical equipment thereof.

To decide on the system of electric traction most suitable for the operation of any system of suburban railroads, involves a discussion not only of the kinds of electric current to be generated by the power station and collected by the moving trains, but also of the method to be adopted for conveying the current to the trains. The system chosen must, in this case, be suitable for extension to deal with the whole of the suburban railroads.

Before visiting Melbourne, I was able, with the data furnished by your Electrification Committee, to make general estimates of how each system would work out, from a financial point of view, for the Victorian Railways, both as regards capital cost and operating expenses. Since my visit I have been able to make a more detailed and exact investigation in the light of my knowledge of the local conditions. As the investigation proceeded, and the conditions to be met with on the system were fully realized, it became apparent that we might put on one side all the systems with the exception of the unprotected third-rail system, the protected conductor-rail system, and the single-phase overhead wire system; I give briefly the reasons which have lead me to this conclusion.



Coaches in Service; Preliminary Stages.

Apart from financial considerations, I am not prepared to recommend a high tension direct-current system for the Melbourne suburban lines on account of the extra complication and cost of the equipment of the trains themselves compared with a direct-current system at a lower voltage. Used with a conductor rail for conveying the current to the trains, pressures of 1,000 volts and over are not the most suitable for such a system of railways as those in Melbourne, and, used with overhead wires, the system does not compare favorably with the single-phase system. The Cologne-Bonn line,* on which a high tension direct-current equipment has given satisfaction, is not comparable with the Melbourne suburban system either as regards the weight and size of trains dealt with, or as regards the extent and importance of the railroad itself. While in special cases a high tension direct-current system, with either overhead wires or conductor rails (depending on the conditions of service), may show advantages, it is not, in my opinion, suited to Melbourne conditions.

The three-phase system has been used with very considerable success for locomotive work and is specially suitable for long runs over heavy gradients. The characteristics of the three-phase motor, however, do not render it the best for a suburban service. The double overhead wires are in themselves a com-

*Abstract of the Report to the Victorian Railways Commissioners on the application of Electric Traction to the Melbourne Suburban Railway System. Published by the courtesy of the commissioners.

* This line may be termed an interurban road.

plication to be avoided in such a case as that under consideration, although on long straight runs without complicated junctions the difficulty is less, and, for such routes, the system has proved in every way successful. For the Melbourne suburban lines I consider that the three-phase system is less suitable than the single-phase system. Having eliminated these systems, I have made a careful comparison in detail between the following alternatives, viz.:—

1. An unprotected third-rail system, working at 600 volts.*
2. A protected conductor-rail system, working at 800 volts.*
3. A single-phase high tension system, working at 10,000 volts.†

The calculations show that a protected conductor-rail system with a voltage of 800 has many alvantages over the unprotected third-rail system at a lower voltage, from both financial and operation points of view. Although the unprotected third-rail system has been operated with great success both in England and abroad, and although the accidents from shock have been remarkably few even in a country like England, where for a large part of the year the ground is more or less saturated with moisture, there is no doubt as to the superiority of the protected conductor-rail system, even in a climate like that of Melbourne. When, in addition, it is found, as is here the case, that an 800-volt protected conductor-rail system can be installed for considerably less money and will operate at a higher efficiency on account of the lower losses in the conductor rails and track, I have no hesitation in recommending it in preference to any unprotected third-rail system, even under the particularly favorable conditions of track and climate existing in Melbourne. For the Melbourne suburban lines, therefore, it comes down to a choice between the 800-volt direct-current protected conductor-rail system and the single-phase overhead wire system.

(To be continued.)

STANDARD TIME AND THE RAILWAY ASSOCIATION.

At the November meeting of the American Railway Association, resolutions were passed congratulating William F. Allen on the successful operation for a quarter of a century of the system of standard time originated by him and adopted in 1883. Mr. Allen replied as follows:

It was the enterprising spirit of the railway men of 1883 which made possible the adoption of Standard Time, and among them I must refer to the names of such men as P. P. Wright, E. B. Thomas, James McCrea, Charles E. Pugh, J. R. Kenly, Geo. W. Parker and H. S. Haines, all well known to you, and to those of J. M. Toucey, A. A. Talmage, H. B. Stone and Charles Stiff, who have passed away. They were all most active and important factors in support of the proposed reform. There are many others worthy of honorable mention, whom I should like to here recognize if time permitted.

Let us look back for a moment at the conditions that prevailed prior to November, 1883. There was then fifty-three times of various cities, in use by our railways and by the people generally, and it is doubtful if there were more than a dozen railway officials in the country who could have stated from memory what time was used upon any road other than their own and the few with whom they had direct business connections. To the traveler the puzzle was a difficult one, and without the aid of a guide almost impossible of solution. So crude were some of these standards that one railroad superintendent reported, in response to a circular of inquiry, that the standard of his road was "the superintendent's watch."

In the task of resolving this chaos into order, the political situation of affairs at that epoch was a fortunate one. The power of the national government and of the state governments was not evoked, nor was it desired, in the movement for the accomplishment of the reform. The co-operation of the officers of the Naval Observatory at Washington, and of the Signal Service department was most cordially given, because they recognized the advantage that would accrue to their respective services.

It had not then been announced as a political axiom, as it was recently, that "men accustomed to large affairs are somehow untrustworthy and must be restrained by those less competent, but more numerous at the polls."

The spasm of unjust prejudice against railways, fostered by ignorance of facts, and fed by personal ambition, now, we trust, about to pass away, had not then begun to exercise its baleful influence; nor had the adoption of unwise methods, for the correction of certain abuses, obstructed the operation and development of our transportation lines and injuriously affected the growth of the industries of our country. There were at the time many men of influence still living, who knew what the country was before our railways had been constructed by their enterprising builders, and who understood and appreciated the part they had played in its progress.

In other parts of the world similar movements of reform in time-keeping have since been accomplished by means of the enactment of laws or by Imperial decrees. Here (and in saying this I do not wish to appear to ignore the co-operation of scientific societies) it was practically the gift of the railways to the public. Following the intelligent leadership of our railroad officials in all parts of the country, the people acted for themselves in adopting the new time, and it was therefore essentially a movement "of the people, by the people, for the people," apart from politics or political influences. Then, having adopted the new custom, in pursuance of that liberty which governs the practices of a free people, they proceeded to enact their custom into law.

It is my belief that no government in this country has ever been strong enough (and I trust none ever will be) to impose upon the American people such a change, even for their common good, as the one they voluntarily adopted on November 18, 1883. Nor could it have been brought about by the government, with all its recent assumption of power, without the free and hearty co-operation of those forces, which then proved sufficient of themselves.

In view of recent existing conditions, I am constrained also to believe that the reform, successful in 1883, would have been hopeless of accomplishment if it had been attempted in 1908.

On that beautiful Sunday morning of November, 1883 (which many of you will recall), when the hour arrived at twelve, by the old time, in New York City, I heard the bells of St. Paul's chapel toll the old hour for the last time, followed by a fateful interval of four minutes. Then, as previously arranged, obedient to an electrical signal from the Naval Observatory at Washington, the Western Union time ball fell, old Trinity's chimes rang out on the new hour, and the chaos of local times over a whole continent was resolved into the order which has since prevailed.

Since then the work of The American Railway Association has steadily progressed onward and upward towards the attainment of the highest degree of efficiency in railway management and operation. You may raise rates as high as justice and reason will permit; you may borrow money for improvements at the lowest rate of interest; you may economize in every way possible; but without efficiency in operation all other things may go for naught. And I venture to assert that the degree of prosperity of any country is in direct proportion to the efficiency of the operation of its railways.

I regard The American Railway Association as having been

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* I should not advise the use of a higher pressure than 600 volts with an unprotected or partially unprotected rail—with a protected rail as proposed, higher pressures are permissible, the limit in practice being the complexity in the train equipment in the case of pressures appreciably above 800 volts (see discussion of high tension direct-current system above).

† My project for the use of the single-phase system has been based on 10,000 volts—a lower voltage such as 6,000 volts (the pressure used at Hamburg) would for the case under consideration be more expensive.

a most potent factor in the advancement of that efficiency and that prosperity. It has never been in the hands of abler men than those of to-day. In thanking you most appreciatively for your action, I desire to say in return, that I know of no wish that will be more acceptable to you, nor one that I can more heartily extend, than that its labors may meet with the same success in the future as they have in the past.

PAYMENT OF RAILROAD LABOR ON TONNAGE BASIS.*

BY J. E. TAUSSIG,
Superintendent Terminals, Wabash R. R., St. Louis, Mo.

The question of payment to labor by the piece has been successfully carried out not only by railroads but also by industrial enterprises. By this system the energetic and thinking employee is enabled to show not only to the employer how much work he is capable of doing, but also is given an opportunity to earn a greater wage than on a straight monthly or hourly basis. In the early part of 1906, the writer made an investigation of the various systems in vogue at Fort Wayne, Ind., Toledo, O., and Chicago, Ill., as to the payment of platform labor by the ton and later the following circular was issued:

"Effective January 16, 1906, all loading clerks, pickers, stowers and truckers, will be paid on a tonnage basis instead of by the month or hour as heretofore.

"By this arrangement the men affected will be given an opportunity to make increased wages over what they are making at present. This system has been in effect at Toledo, Fort Wayne, Chicago and other cities for some time and has been found to work to the advantage of both the men and the company: the men being able to make somewhat better wages, and the company getting more freight handled per man on account of the men being interested in handling the freight promptly, as they are paid for every pound they handle. This is an important feature with the Wabash at St. Louis on account of the expected increased tonnage to be handled at Fourth Street Station in the near future.

"The following rules and rates of pay will apply to the new system:

"1. All gangs will consist of one loading or check clerk, one picker, one stower and two truckers, unless otherwise instructed by the warehouse foreman.

"2. Loading or check clerks will be paid at rate of 4.7 cts. per ton for all the tonnage handled by the gang of which they have charge.

"3. Pickers and stowers will receive 13½ cts. per ton and truckers 12.6 cts. per ton. The total tonnage handled by each gang to be divided equally among the men in the gang. Example: A gang handles 100,000 lbs., or 50 tons, in a day. The picker and stower in that gang will be allowed 12½ tons each at 13½ cts., and the truckers 12½ tons each at 12.6 cts. per ton. The company will guarantee that each picker and stower will make not less than 16 cts. and every trucker not less than 15 cts. per hour for every hour worked during each month.

"4. The tonnage for each car will be attached to the tickets for that car so that clerks in charge of gangs may know the tonnage they handle.

"5. All outbound freight should be weighed by loading clerks and payment made on corrected weight. In case of erroneous weights being reported, loading clerks with be held responsible and be disciplined accordingly.

"6. Bulletin showing tonnage handled and hours worked by each gang will be posted in the warehouse foreman's office daily, for work done the day previous.

"7. Any employee affected by these rules will be permitted to check the tonnage made by him in case of shortage in pay check or errors once each month.

"8. All freight must be carefully and correctly handled and stowed in cars. Bulletins showing names of clerks or men damaging freight, or freight loaded in error, will be posted in the foreman's office and book record will be kept by the agent of these matters."

The result of this arrangement was, that the men themselves regulated the number of gangs to be employed according to the amount of freight to be handled, and that less supervision was required. It was further found that by paying the check clerks by the ton, each clerk in charge of a gang was equally interested with the men in the quick and proper handling of freight and further did not give the men an opportunity to complain that the clerk was slow and had no interest in the amount earned by the men in the gang.

Our experience has been that the system is better both for the railroad company and the employee. The damage to freight was no greater than under the hourly system notwithstanding the statements that have been made to the contrary. It has been claimed that more freight is damaged as the men in trying to handle the freight more quickly in order to earn greater wages are handling it more roughly and carelessly than they did by the hour, but this has not been our experience. A close check of the tonnage is kept in the agent's office and no payment for tonnage not actually handled has been made.

The system of payment to clerks by the piece has worked out about in the same manner as with the platform force. At our Fourth street station expense bill, way bill and claim clerks only are paid by the piece. With the expense bill clerks it was found that a considerably less number was required, and bills and notices were more promptly made out, thereby increasing the efficiency of the freight house facilities by reason of the freight being more quickly removed by the consignee. It was also found that the clerks took home with them at night expense bill blanks and carbons, folded the blanks and inserted the carbons and brought them back to the office the following morning, in this manner saving the time necessary to perform this labor, during office hours, and enabling them to get out a greater number of bills and make increased wages. Further, better and more careful clerks were secured, as they were able to earn one-third more wages than on the hourly basis. All complaints as to long hours, reduced force, etc., ceased. It was immaterial to the agent how many clerks were employed, as the expense to the company was the same. The same was true of other clerks similarly paid.

There are two main features to be cared for in putting the above system into effect for any class of labor:

The employee must be fully advised and made familiar with the manner in which the payment is to be made, how much he can earn if he applies himself and, further, he must be guaranteed as a minimum the wages he was able to make either on the monthly or hourly basis. Unless the employee understands the matter as fully as the official that desires to put it into effect, it can not be successfully worked out.

A proper and intelligent check must be made of each item and a record kept so that no credit is given for work not actually performed. This can be done by reliable piece work inspectors using check sheets, the same to be personally checked by the head of the department occasionally in order to satisfy himself that the allowances are correct.

Within the past year the payment of labor by the ton has been put into effect by one of the large English railroads and I am advised that it is working out so successfully to both the management and employees that other railroads in Great Britain expect to follow the same plan. There seems to be no question that all American railroads that are making payments under this system have found it more economical, if properly checked and supervised, than on the monthly or hourly basis, and that in general it is more satisfactory to the employee.

*A paper read before the Central Association of Railroad Officers, Peoria, Ill., October 14, 1908.

RUSSIAN PASSENGER FARES.

Not long ago the fares of first and second class passengers on the Russian railroads were raised, as the former rates were declared unprofitable; but the result has been to divert a large part of the second-class travel to the third class and a frightful increase in traveling on counterfeit tickets, or tickets already used, with the connivance of the conductors. One of the St. Petersburg newspapers asserts that on many routes scarcely one passenger in five has a regular ticket. It declares that it is such dishonesty which threatens the railroads with bankruptcy. The number of employees constantly increases, but the more there are the less work they do, and they conspire together to rob the railroads.

SOUTHERN PACIFIC AIR BRAKE TESTS.

I.

The following report covers the results of comparative demonstrations for determining the distinctive features of standard and improved air-brake equipment for freight and passenger cars conducted jointly by Southern Pacific Company, Pacific system, and the Westinghouse Air-Brake Co.

OBJECT OF THE TESTS.

The tests were made for the purpose of demonstrating the improvements in the "K" triple valves by comparing their use under similar conditions with the work done by the "H" triple valves, and further, as far as possible, to determine the benefits to be derived from the use of such improvements in service, such as increase of tonnage, which could be handled with greater factor of safety down mountain grades, general improvements in train handling, and also the results to be secured through a transition period, i.e., where only a partial equipment of "K" triple valves might be in service. It was also desired to obtain records to show why the difference, as shown by the results, exists.

The features peculiar to "K" triple valves, which were brought out in the tests, are as follows:

The quick service feature, which hastens the time of serial action of brakes through long trains in service applications in a similar way to the hastening of the time of serial action in emergency, the emergency being the same as before; the service time, however, being practically cut in two.

This result is brought about by each "K" triple valve making a local reduction of brake-pipe pressure on each vehicle by taking a quantity of air out of the brake-pipe and admitting same to brake cylinder, the local reduction thus made setting the triple valve in action on next adjoining vehicle, such action, by the way, resulting whether the next triple be "K," "H" or any other type. The brake-pipe air placed in the brake-cylinder being equal approximately to the displacement of the piston, permitting the air then admitted from the auxiliary reservoir to extend the packing leather, quickly move the piston beyond the leakage groove and build up pressure immediately, instead of to first fill the vacuum created by movement of piston and to supply the loss of pressure through the leakage groove as with the old triple valves.

This local reduction on each vehicle results in complete serial action of brakes through trains of any length with only very light reduction on head end, securing the effective use of brakes uniformly on all vehicles in trains of any length, whereas, with triple valves other than "K," the serial action in service application often ceases entirely before reaching middle of train, or skips miscellaneously through long trains, resulting in only one-third to one-half of brakes being applied, except in emergency. (See Fig. 5.)

The uniform release feature was added to retard the escape of pressure from brake-cylinder on vehicles on head end of train until the pressure in brake-pipe could be raised sufficiently on rear end to start release of rear brakes, then, all brakes continuing to release together, zero is reached at about the same time on all vehicles. Therefore, shocks and break-in-twos are avoided, making it possible to permit the engineers to release the brakes on trains equipped with "K" triple valves at any time desired, without the necessity of completing a stop, this uniform release feature adding to the cars the well-known assistance derived from the use of independent brakes on the locomotive.

The uniform re-charge feature was added to the "K" triple valve to retard the re-charge of auxiliary reservoirs on vehicles at head end sufficiently to compensate for the difference in time required to raise pressure in brake-pipe at rear end of long train, the auxiliaries on rear end being the particular governing factor, especially in grade work, to secure uniform work done by brakes on all vehicles.

This uniform re-charge is brought about by slightly restricting the ports to the auxiliaries on head end, but it will be appreciated that, as the pressure is higher in brake-pipe on such head vehicles, the rate of re-charge through the smaller port thus secured will be practically the same as with the less differential working against the unrestricted ports opened to the auxiliary reservoirs on vehicles in rear end of train, so that pressure in all auxiliary reservoirs will reach maximum at about the same time.

The uniform re-charge feature, by having the smaller openings deducting pressure from brake-pipe on head end, makes it easier to secure prompt rise of pressure in brake-pipe on rear end of train, thus practically insuring the movement of all triple valves in train to release position, avoiding stuck brakes and slid-flat wheels caused by non-release of brakes. This feature also prevents over-charge of auxiliary reservoirs on head end of train during release and re-charging, thus avoiding undesired re-application of brakes.

It has been determined also that a large number of break-in-twos occur from attempts to start long freight trains with brakes applied at rear end. The uniform re-charge feature of the "K" triple valve, insuring the release of all brakes in the train, guards against brakes remaining applied at rear end and causing break-in-twos, and also the uniform release feature, retarding the escape of brake-cylinder pressure on head end until rear brakes have started to release, makes it difficult for engineers to move trains until all wheels can revolve.

H. H. Young, General Air Brake Inspector of the Southern Pacific, was in charge of the tests as representative of the railroad, and C. C. Farmer, Resident Engineer, in charge of tests, representing the Westinghouse Air-Brake Company. These were assisted by a staff of 20 men who were well trained for their duties.

THE TEST TRAIN.

To represent the most modern operating conditions in weight and length of train both as to total and per vehicle 80 class 0-50-2 oil cars were selected as offering the greatest length and weight of freight cars. The 80-car train was over 3,500 ft. long and had over 3,700 ft. of brake-pipe and hose connections.

The cars were fitted with 10-in. air-brake equipment, which with the 3,700 ft. of brake-pipe made probably the longest train and largest volume of air to be handled of any test or demonstration ever conducted.

Bassett, Cal., was selected as the best available location for the standing and running 80-car empty train tests on account of level track for the stops, slight grade at Puente, three miles distant, to aid in acceleration, and probably the most uniform atmospheric conditions obtainable anywhere. Beaumont and Siskiyou grades were selected for the tonnage handling tests to determine whether the present tonnage rating of 80 ms. per operative brake for Siskiyou and 110 ms. for Beaumont could be increased with safety by the use of the improved air-brake equipment.

The results of the tests have been printed in an elaborate report of 144 pages, from which we are permitted to publish the following abstract:

The report contains first, all of the data secured; second, it illustrates graphically the results obtained, and third, shows composite diagrams for ready observation of the comparisons which the demonstrations brought out.

STANDING TESTS—SERVICE APPLICATIONS.

It was desired to obtain readings of instruments more or less delicate on different cars throughout the train, which could not readily be made during running tests, therefore records were taken with train at rest by the means of brake-cylinder pressure recorders, which were applied to the first, 25th, 50th and 80th cars, to record the movement of brake-valve handle to service and lap positions, start of brake-cylinder piston, movement to 6 in. travel, air pressure in brake-cylinder and time interval between movement of brake-valve

handle and start of application of brakes on the cars. The train was fitted with telephones on engine, 25th, 50th, 80th and dynamometer cars to facilitate communication and for collecting the data as the tests proceeded. The brake-cylinder pressure recorders were electrically connected to the brake-valve on locomotive. On Table 1 is given the official data taken during this series of demonstrations and on the plates following are graphical illustrations of the results secured.

LINE	DATE	DEMONSTRATION	TYPE OF TRIPLE	BRAKE PIPE REDUCTION ON ENGINE DESIRED	BRAKE PIPE REDUCTION ON ENGINE ACTUAL	1ST CAR: TIME IN SECONDS FROM MOVEMENT OF BRAKE VALVE HANDLE TO EQUALIZATION	1ST CAR: BRAKE CYLINDER PISTON MOVEMENT STARTED TO MOVE (SECONDS)	1ST CAR: BRAKE CYLINDER PISTON MOVEMENT MOVED TO FULL TRAVEL (6½") AVERAGE (SECONDS)	1ST CAR: BRAKE CYLINDER PRESSURE AT EQUALIZATION (LBS.)	1ST CAR: TIME INTERVALS FROM MOVEMENT OF BRAKE VALVE UNTIL PRESSURE IN BRAKE CYL. IS REDUCED TO 5 LBS.	25TH CAR: TIME IN SECONDS FROM MOVEMENT OF BRAKE VALVE HANDLE TO EQUALIZATION	25TH CAR: BRAKE CYLINDER PISTON MOVEMENT STARTED TO MOVE (SECONDS)	25TH CAR: BRAKE CYLINDER PISTON MOVEMENT MOVED TO FULL TRAVEL (6½") AVERAGE (SECONDS)	25TH CAR: BRAKE CYLINDER PRESSURE AT EQUALIZATION (LBS.)	25TH CAR: TIME INTERVALS FROM MOVEMENT OF BRAKE VALVE UNTIL PRESSURE IN BRAKE CYL. IS REDUCED TO 5 LBS.	50TH CAR: TIME IN SECONDS FROM MOVEMENT OF BRAKE VALVE HANDLE TO EQUALIZATION	50TH CAR: BRAKE CYLINDER PISTON MOVEMENT STARTED TO MOVE (SECONDS)	50TH CAR: BRAKE CYLINDER PISTON MOVEMENT MOVED TO FULL TRAVEL (6½") AVERAGE (SECONDS)	50TH CAR: BRAKE CYLINDER PRESSURE AT EQUALIZATION (LBS.)	50TH CAR: TIME INTERVALS FROM MOVEMENT OF BRAKE VALVE UNTIL PRESSURE IN BRAKE CYL. IS REDUCED TO 5 LBS.	80TH CAR: TIME IN SECONDS FROM MOVEMENT OF BRAKE VALVE HANDLE TO EQUALIZATION	80TH CAR: BRAKE CYLINDER PISTON MOVEMENT STARTED TO MOVE (SECONDS)	80TH CAR: BRAKE CYLINDER PISTON MOVEMENT MOVED TO FULL TRAVEL (6½") AVERAGE (SECONDS)	80TH CAR: BRAKE CYLINDER PRESSURE AT EQUALIZATION (LBS.)	80TH CAR: TIME INTERVALS FROM MOVEMENT OF BRAKE VALVE UNTIL PRESSURE IN BRAKE CYL. IS REDUCED TO 5 LBS.	NUMBER OF BRAKES APPLIED	BRAKES FARTHEST BACK IN TRAIN TO APPLY TO FULL TRAVEL (6½")	TYPE OF TRIPLE	REMARKS	LINE
1	9/11	29A	K	5	5½	17 Sec	.80	3.80	10.00		20 Sec	3.30	16.00	12.00		20 Sec.	8.75	28.00	7.50		"20 Sec.	13.00	29.80	7.50				K		1
2	9/11	29AA	"	"	6	20 "	.80	4.00	11.00		20 "	2.70	13.00	10.50		20 "	6.25	—	6.50		20 "	9.00	—	7.50				"		2
3	9/11	29B	"	"	5	20 "	.80	2.80	9.50		20 "	3.00	32.00	9.00		20 "	6.20	No Contact	8.00		20 "	8.00	—	7.75				"		3
4	9/11	129	H&K	"	5½	25 "	.25	6.00	10.00		25 "	4.70	—	10.00		25 "	16.60	—	7.00		25 "	18.25	—	7.00				H&K		4
5	9/11	129B	"	"	4½	25 "	—	—	—		25 "	5.50	18.00	8.50		25 "	10.00	—	6.50		25 "	27.50	—	5.50				"		5
6	9/11	129E	"	"	5½	25 "	.80	6.00	10.75		25 "	8.00	—	9.00		25 "	19.00	No Contact	6.00		25 "	18.00	No Contact	6.00				"		6
7	9/11	229	H	"	5	27 "	.60	1.80	9.00		27 "	6.90	—	9.00		27 "	No	Movement			27 "	No	Movement					H		7
8	9/11	229A	"	"	4½	27 "	.80	1.80	9.00		27 "	4.60	—	7.50		27 "	"	"	"		27 "	"	"	"				"		8
9	9/11	229B	"	"	4	—	—	—	—		27 "	7.00	—	7.50		27 "	"	"	"		27 "	"	"	"				"		9
10	9/11	229C	"	"	4	—	—	—	—		27 "	10.00	—	7.00		27 "	"	"	"		27 "	"	"	"				"		10
11	9/11	229D	"	"	4	—	—	—	—		27 "	10.00	—	3.00		27 "	"	"	"		27 "	"	"	"				"		11
12	9/11	229E	"	"	5	27 Sec.	.80	8.00	9.50		27 "	6.40	—	8.75		27 "	"	"	"		27 "	"	"	"				"		12
13	9/11	30	K	10	9½	31 "	.80	3.60	19.00		31 "	3.40	12.70	25.00		31 Sec.	9.25	18.75	12.00		31 Sec.	13.00	21.50	17.75				K		13
14	9/11	30A	"	"	10	—	—	—	—		31 "	2.60	14.00	21.50		31 "	6.00	15.00	18.00		31 "	8.30	16.00	18.00				"		14
15	9/11	130	H&K	"	10	40 Sec.	.60	4.50	19.00		40 "	5.90	20.00	19.00		40 "	12.80	24.00	14.00		40 "	15.50	27.00	16.50				H&K		15
16	9/11	230	H	"	10	50 "	.70	12.00	22.50		50 "	5.00	31.40	18.00		50 "	24.25	42.00	9.00		50 "	35.50	No Contact	8.00				H		16
17	9/11	230A	"	"	10	50 "	.70	8.75	22.00		50 "	4.60	30.00	17.50		50 "	16.40	34.00	11.50		50 "	27.75	49.00	9.00				"		17
18	9/11	31	K	15	14	40 "	.80	5.40	32.00		45 "	3.50	12.80	36.00		45 "	8.80	14.50	35.50		45 "	12.80	21.50	28.00				K		18
19	9/11	31A	"	"	14.5	45 "	.80	2.50	36.00		45 "	2.90	14.00	29.00		45 "	6.00	15.00	30.00		45 "	9.00	16.70	29.00				"		19
20	9/11	131	H&K	"	14	53 "	.60	5.00	30.00		53 "	4.00	16.00	37.00		53 "	11.75	21.25	31.50		53 "	17.00	30.00	25.00				H&K		20
21	9/11	231	H	"	14	60 "	.80	9.00	31.50		60 "	5.60	27.50	27.50		60 "	17.00	35.00	23.00		60 "	30.25	45.00	19.00				H		21
22	9/11	32	K	25	24	92 "	.40	3.50	53.50		92 "	.325	14.00	54.00		92 "	7.80	15.00	42.00		92 "		21.50	51.50				K		22
23	9/11	32A	"	"	25	92 "	.70	2.70	54.00		92 "	3.00	2.30	55.00		92 "	5.30	16.00	48.50		92 "	8.00	19.00	52.50				"		23
24	9/11	132	H&K	"	24	76 "	.70	6.80	53.00		96 "	4.75	14.25	50.00		96 "	11.50	24.40	46.00		96 "	15.00	25.50	56.00				H&K		24
25	9/11	232	H	"	24	100 "	.70	9.00	56.00		100 "	5.50	27.50	51.00		100 "	18.80	35.00	43.00		100 "	29.00	44.50	45.00				H		25
26	9/11	33	K	5																						80	80th	K		26
27	9/11	133	H&K	"																						79	80 "	H&K	55th Did Not Apply.	27
28	9/11	233	H	"																						47	53rd	H	35th 37th 39th 47th 48th 50th and All Back 55th Did Not Apply.	28
29	9/11	34	K	10																						80	80th	K	All Applied When Reduction Reached 5 Lbs.	29
30	9/11	134	H&K	"																						79	80 "	H&K	31st (H. Triple) Did Not Apply.	30
31	9/11	234	H	"																						80	80 "	H		31
32	9/11	35	K	15																						80	80 "	K	All Applied When Reduction Reached 10 Lbs.	32
33	9/11	135	H&K	"																						78	80 "	H&K	31st (H. Triple) & 78th (K Triple) Did Not Apply.	33
34	9/11	235	H	"																						80	80 "	H	All Applied When Reduction Reached 10 Lbs.	34
35	9/11	37A	K	"	15					14.8					16.2					14.6					14.5			K		35
36	9/11	237A	H	"	15½					4.5					6.7					17.2					40.0			H		36

TABLE A.

AIR CONSUMPTION COMPARISONS WITH K (IMPROVED) & H (STANDARD) TRIPLE VALVE						
DATE 1908	DEMONSTRATION	TYPE OF TRIPLE	BRAKE PIPE REDUCTION DESIRED	BRAKE PIPE REDUCTION ACTUAL	STOP IN FEET IN COMPARATIVE RUNNING TESTS	NUMBER OF SINGLE STROKES OF AIR PUMP NECESSARY TO RECHARGE MAIN RESERVOIR TO ORIGINAL PRESSURE OF 80 LBS.
7/3	36	K	5	5	1780	122
7/3	131	H	20	20	1700	474

TABLE B.

BRAKE PIPE LEAKAGE IN LBS. AFTER 10 LBS. REDUCTION FROM 80 LBS. ON 80 CAR TRAIN IN STANDING DEMONSTRATIONS.	
DATE 1908	LBS PER MINUTE
7/1	2 " "
7/2	2 " "

-NOTE-

ABOVE DEMONSTRATIONS WERE MADE WITH A TRAIN OF 80 S.P.COS OIL CARS. CLASS 0-50-2: CAPACITY 12430 GALS LENGTH OVER END SILLS 41'-10" TOTAL LENGTH OF TRAIN 3500 FT

Table 1—Standing Application Demonstration, Comparative Tests of Westinghouse Improved and Standard Air Brake Equipment for Freight Cars. Bassett, Cal.; July, 1908.

These demonstrations were made with a train of 80 Southern Pacific oil cars. Class 0-50-2. Capacity, 12,430 gals. Length over end sills, 41 ft. 10 in. Length of train, 3,500 ft.

SPEED OF APPLICATION OF BRAKES THROUGH THE TRAIN.

The most important reason for improvement in air-brake equipment for freight cars was to hasten the serial action when applying the brakes with service applications; therefore it was desirable to record the time of serial action with the old and new triple valves, and half new and half old to determine whether the time had been halved by the new K triple making a local reduction in the brake-pipe.

Service applications of 5, 10, 15 and 25-lb. brake-pipe reductions were made with the train fitted with the different combinations of equipment, that is, all "K," half each "K" and "H," and all "H" triple valves.

By reference to Table 1, where all of the records are given, it will be noted that in no case was the time with K triple valves equal to over one-half the time required to run the serial action through the train with standard triple valves.

Fig. 2 shows results of 5-lb. brake-pipe reduction (light application) illustrating the loss of serial action entirely with standard equipment, but complete in 13 seconds with K triples and in 21.2 seconds with half K and half standard.

This graphically explains why the train was stopped in approximately 1,700 ft. with the K and 4,200 ft. with the standard from 30 miles per hour in the running tests with this reduction. (See Fig. 9.)

COMPARATIVE SPEED OF SERIAL ACTION—MEDIUM APPLICATION.

By using a 10-lb. brake-pipe reduction to apply the brakes the serial action was completed through the train with each kind of triple valves, but it will be interesting to note that the time was halved with the K triple, owing to the local brake-pipe reduction made on each vehicle, and the action was nearly as rapid with half and half, warranting the statement

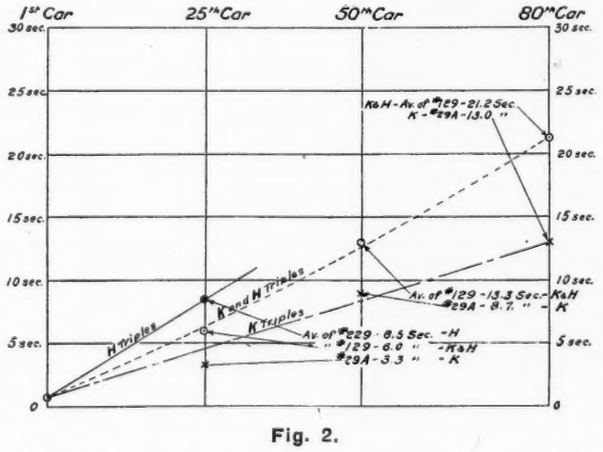


Fig. 2.

5-lb. brake-pipe reduction. Time in seconds to first movement of brake cylinder piston.

that each K triple valve improves the next adjacent triple whatever it happened to be, hence an improvement through the transition period. The completion of serial action through the train does not mean, however, that all the brakes were applied uniformly. See Fig. 5 to note better distribution of pressures with the K triples.

COMPARATIVE SPEED OF SERIAL ACTION—HEAVY APPLICATION.

To apply the brakes with nearly maximum force it is necessary to reduce the brake-pipe pressure considerably and as rapidly as can be permitted and not throw the triples into quick action.

In long trains the friction in brake-pipe and volume of air to be handled is so great that no matter what is attempted at the brake valve, the time is not improved materially, but by venting the brake-pipe at each triple the serial action is materially hastened and a stone wall is not built up on head end by the excessive pressures secured in the attempt to hasten the action at rear end. (See Fig. 5.)

COMPARATIVE SPEED OF SERIAL ACTION—FULL APPLICATION, TO EQUALIZATION.

Fig. 3 graphically illustrates the remarkable result of starting the brakes on rear of the 80-car train with the K triple in 8 seconds as against 29 seconds with standard triples.

The ideal brake would, of course, have no time of serial

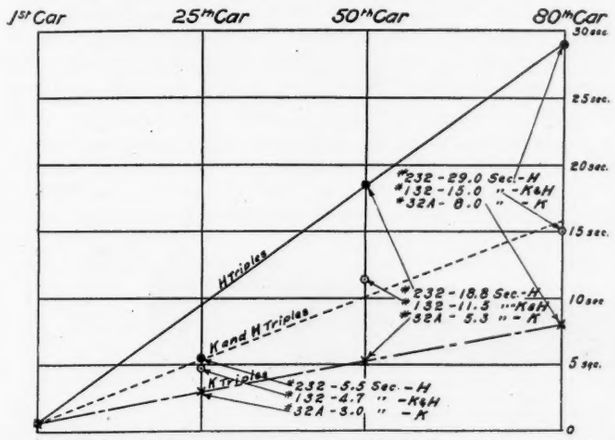


Fig. 3—(See Table 1) Standing Application. Time of Serial Action of Brakes Through Train.

25-lb. brake-pipe reduction. Time in seconds to first movement of brake cylinder piston.

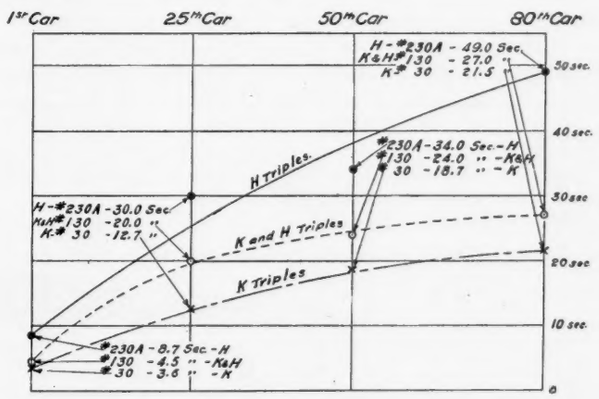


Fig. 4—(See Table 1). Standing Application. Serial Action of Effective Braking Pressures.

10-lb. brake-pipe reduction. Time in seconds for 6-in. piston travel.

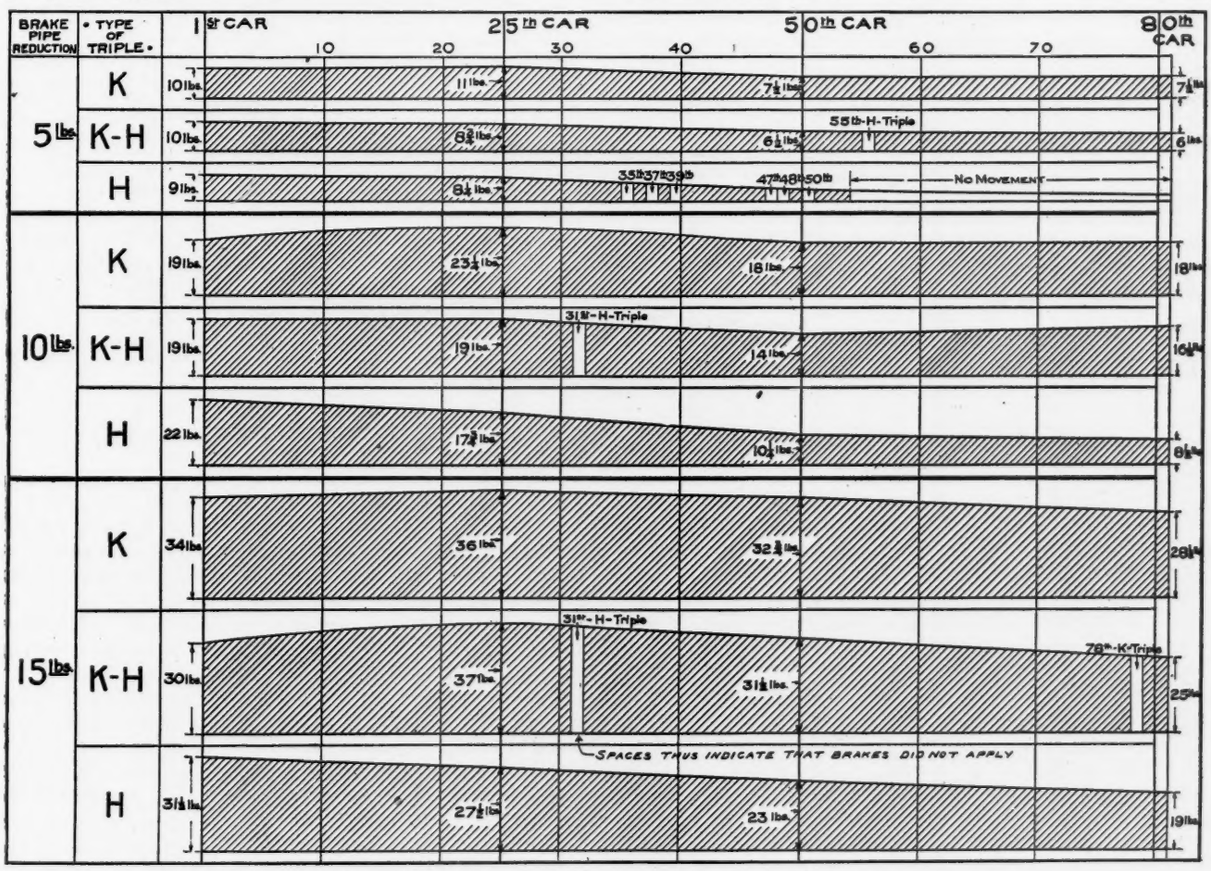


Fig. 5—Standing Application. (See Table 1 and Fig. 6).

Number of brakes applied and characteristic brake cylinder pressures from 5, 10 and 15-lb. brake-pipe reductions.

action, but for some years to come it will no doubt serve every purpose if the brakes can be applied serially in long trains faster than the slack can run in.

COMPARATIVE SERIAL ACTION OF EFFECTIVE BRAKE-CYLINDER PRESSURES—MEDIUM APPLICATION.

The end desired is to apply the brakes on rear end of long trains before the slack can run in or before the brakes are applied heavily on head end.

Fig. 4 is of more than ordinary interest in illustrating that there was but a difference of 17.9 seconds between securing 6-in. piston travel on first and 80th cars with the improved equipment as against 40.3 seconds with standard triples.

COMPARATIVE SERIAL APPLICATIONS—ILLUSTRATING WORK DONE.

Fig. 5 shows graphically the effect of 5, 10 and 15-lb. brake-pipe reductions with the different combinations of triple valves on a long train. The desired result is to apply all brakes with any reduction; to apply the brakes effectively; to apply the brakes fast enough serially to keep slack from running in; to get the most brake-cylinder pressure with the least deduction from the stored volume (auxiliaries), and to apply the brakes uniformly. It will be seen on Fig. 4 that 6 in. piston travel (effective braking pressure) had been secured with the K triples on the 80th car with all reductions in less than half the time of the H triples.

Having these points in mind, the comparisons shown on Fig. 5 are interesting.

These diagrams illustrate the condition of brake-cylinder pressure areas throughout the train at the completion of applications.

The more uniform and higher pressures in the K diagrams are interesting as compared with the tapering pressure areas from front to rear of train with the H triples.

The "work done" is in proportion to the total area of the diagrams, plus the fact that effective pressures are secured in less than half the time with the improved equipment.

The shocks in a long train are in direct proportion to the time of serial action and the uniformity of pressure distribution.

Fig. 6 further illustrates the comparative time of serial action of first movement of brake-cylinder pistons and effective pressure through trains from different brake-pipe reductions.

COMPARATIVE SERIAL APPLICATIONS, AS TO BOTH TIME AND PRESSURES.

On Fig. 6 are shown tracings of brake-cylinder indicator charts taken from 25-lb. brake-pipe reductions (maximum brake applications). These diagrams are so placed as to show comparative "Work Done"; first, as to time of serial action; second, as to the comparative work done during the early part of applications, and third, as to total pressure areas secured.

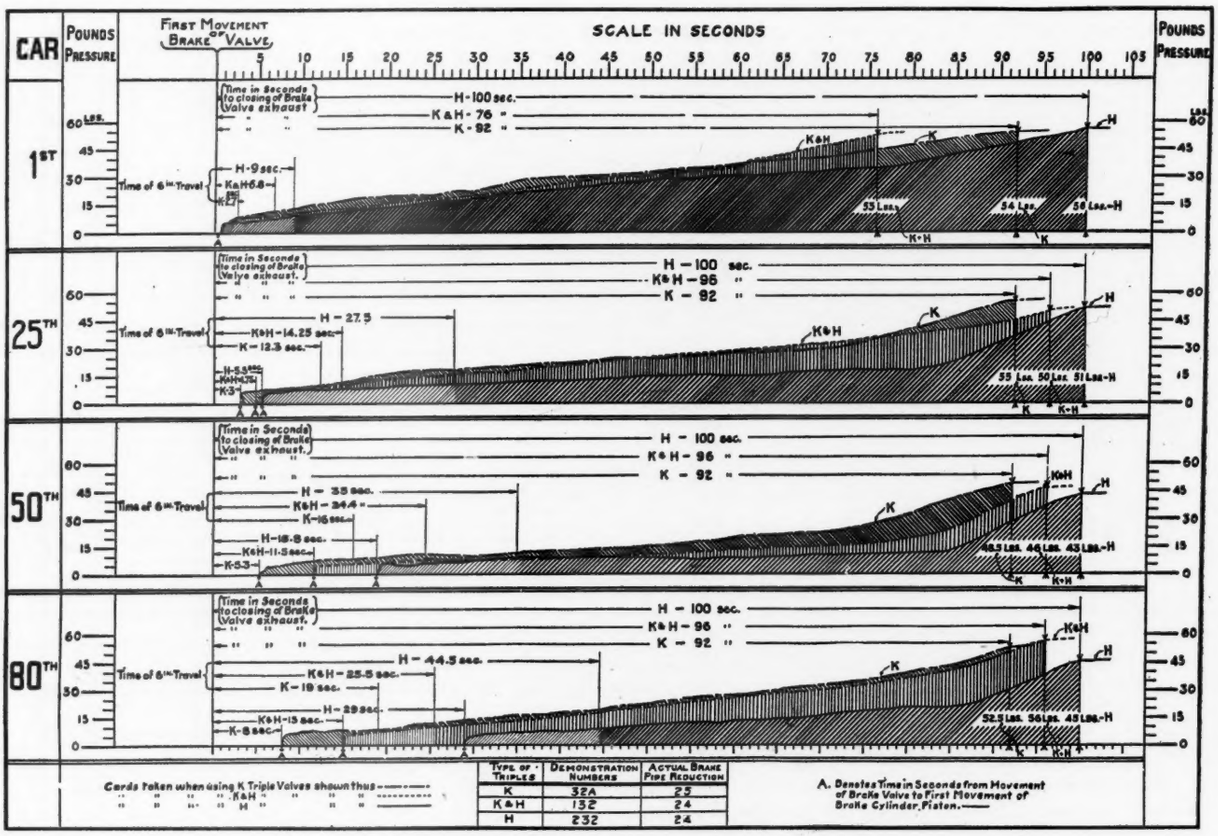


Fig. 6—Standing Application. Brake Cylinder Indicator Cards.

Showing comparative serial action, time of 6 in. piston travel, and cylinder pressures at end of reduction, with train of 80 freight cars. 25-lb. brake-pipe reduction.

It is of great importance that the time of serial action of effective pressures through freight trains be reduced to the lowest possible point, and it will be noted that with the maximum brake applications represented on Fig. 6, that the brake on the 80th car started to apply in eight seconds with the K triple valves, as compared with 29 seconds with the H triples, warranting the statement that the K triple valves have shortened the time sufficiently to overcome the difficulties which have made it necessary to develop air-brake equipment to secure improved time of serial action.

The K triple valves have accomplished everything in this direction that can be expected of equipment which is to work through the medium of present standard hose connections and in harmony with any and all other equipment in foreign car interchange, and the improved time shown is sufficient for all immediate requirements.

No further reductions in time of serial action will be pos-

sible until electrically operated equipment is used, through which, of course, all time of serial action could be eliminated.

UNIFORM RELEASE DEMONSTRATION—TRAIN AT REST.

The purpose of this demonstration was to take records of time of starting of each triple valve to release, time after release starts until brake-cylinder pressure is reduced to 5 lbs. (brake-shoes free from wheels) and time from movement of brake-valve until cylinder-pressure is reduced to 5 lbs., to illustrate graphically why it is impossible to release brakes at slow speeds with standard equipment and that it can be safely permitted with the "K" triple valves.

The brakes were applied with a 15-lb. reduction and then released with the "K" and "H" triple valves.

Records were taken on the first, 25th, 50th and 80th cars with the brake-cylinder recorders used in the standing application demonstrations which recorded the movement of brake-valve from lap to release position, the start of triples to release, the time interval between movement of brake-valve and start of release of triples and the fall of brake-cylinder pressure.

Fig. 7 illustrates by means of comparative curves the result of the K triple valves retarding the escape of air from brake-cylinders on head vehicles in train until the rear end

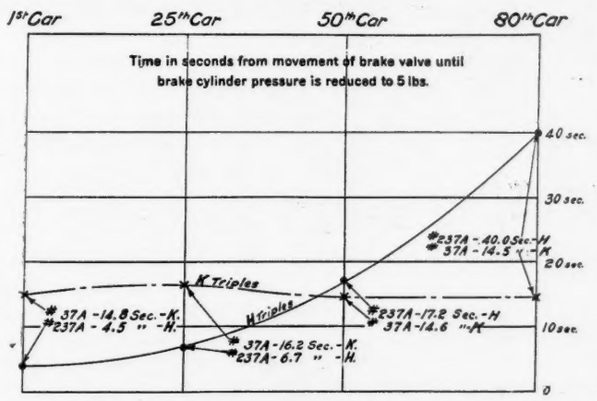


Fig. 7—Standing Release Demonstration. Comparison of Serial Action of Release.

triples can be started to release with full opening, accomplishing uniform release as against the old method of permitting full release on head end with brakes still fully applied on rear end.

It will be noted that the escape of pressure out of the brake-cylinders was withheld sufficiently through the uniform release feature of the K triple valve to permit rear brakes to be released nearly two seconds ahead of those on the front part of the train even as far back as the 25th car.

This result is in marked contrast to the prompt escape of pressure from brake-cylinders on head end with H triple valves and the slow release on rear end.

Interesting composite diagrams will be found on Fig. 8 following, further illustrating the comparative time of release of brakes through the train.

Fig. 8 shows similar comparisons by composite diagrams for ready observation of reasons for the perfect accomplishment of release of brakes at any speed with the K triple valves in the running tests as against break-in-twos with the standard.

These diagrams represent the pressure areas through the train during release of brakes and are plotted in composite form to illustrate pressure distribution with each kind of triple valve at any given time period during the release.

The composite diagrams are arranged vertically on the plate to permit comparison between the two kinds of triple valves of the pressure distribution during release.

This makes it possible to get a comprehensive idea of the reason for the slack running out at front end of train with disastrous results during release of brakes with standard equipment on account of the anchor caused by brakes at rear end still holding, in marked contrast to the brake-shoes being against the wheels of all cars in the train until uniformly released with the K triple valve.

It will be easily noted why an engineer would be prevented from causing a break-in-two or slid flat wheels by attempting to start train before all brakes were released—with the K triple valves the train could not be started as the front brakes are on effectively as long as the rear brakes.

RUNNING APPLICATION DEMONSTRATIONS—QUICK SERVICE FEATURE.

The preceding plates contain data and shown results of tests made with the train at rest mainly for the purpose of illustrating the requirements of air-brake equipment to meet present operating conditions of long trains as to the volume of air to be handled and the length of time which must necessarily elapse between the engineer's attempt to apply or release the brakes and their actual operation on the different vehicles throughout the train, and to show the comparative actual movement of the operative parts of the air-brake equipment and the pressures obtained with the different triple valves with the train wholly or partially equipped with any given kind of triples.

With these records obtained with the train at rest a better appreciation will be had of the reasons for the results ob-

TABLE NO. 2.—RUNNING TEST OF QUICK SERVICE FEATURE—5 LBS. BRAKE PIPE REDUCTION.

Los Angeles Division. SOUTHERN PACIFIC CO. *Bassett, Cal., July,* 1908.

Date.	Demonstration.	Type of triple.	No. of cars in train.	Location of dynamometer car.	Brake pipe pressure at application—Engine.	Brake pipe pressure at application—Dynam. car.	Auxiliary reservoir pressure on last car at application.	Actual brake-pipe reduction on engine.	Brake-pipe leakage in lbs. per minute.*	Speed in miles per hr.—Desired.	Speed in miles per hr.—Act'l from dyn. car.	Length of stop in ft.	Temp'ture of atmosphere, degs. F.
July 2, 1908.....	1	K	81	25th.	80 lbs.	81½ lbs.	80 lbs.	5 lbs.	3 lbs.	5	5.00	93.50	82
June 23, 1908.....	101A	K & H	81	25th.	80 "	79 "	79 "	5 "	3 "	5	5.00	123.94	81
June 30, 1908.....	201	H	81	25th.	81½"	80½ "	80 "	5 "	3 "	5	5.70	173.96	83
July 1, 1908.....	201A	H	81	25th.	81¼"	79½ "	80 "	4 "	2 "	5	5.10	204.40	64
July 3, 1908.....	2	K	81	25th.	80 "	81 "	80 "	5 "	3 "	10	10.50	330.52	77
June 23, 1908.....	102A	K & H	81	25th.	80¾"	79½ "	79 "	5¾"	3 "	10	10.10	321.82	81
June 30, 1908.....	202	H	81	25th.	82 "	80½ "	80 "	4½"	3 "	10	10.40	858.91	72
July 2, 1908.....	3	K	81	25th.	80 "	81 "	80 "	5 "	3 "	15	15.70	667.58	82
June 23, 1908.....	103	K & H	81	25th.	80½"	79½ "	80 "	5¼"	3 "	15	14.60	687.14	86
June 30, 1908.....	203	H	81	25th.	82 "	80½ "	80 "	4½"	3 "	15	15.10	1,780.91	67
July 3, 1908.....	4	K	81	25th.	80 "	81½ "	80 "	5 "	3 "	20	20.25	902.42	65
June 23, 1908.....	104	K & H	81	25th.	80½"	79½ "	80 "	5½"	3 "	20	20.26	1,052.46	86
June 30, 1908.....	204	H	81	25th.	82 "	80 "	.. "	4½"	3 "	20	20.25	2,296.27	62
July 2, 1908.....	5	K	81	25th.	80 "	81¼ "	80 "	5¼"	3 "	25	25.60	1,261.21	80
June 23, 1908.....	105	K & H	81	25th.	80½"	79 "	80 "	6½"	3 "	25	26.20	1,374.21	85
June 30, 1908.....	205	H	81	25th.	82 "	81 "	80 "	5 "	3 "	25	25.70	3,309.59	80
July 2, 1908.....	6A	K	81	25th.	80 "	81 "	80 "	5 "	3 "	30	30.60	1,780.91	82
June 24, 1908.....	106	K & H	81	25th.	80¾"	80 "	80 "	5¾"	3½"	30	30.25	1,987.49	65
June 30, 1908.....	206	H	81	25th.	82 "	80½ "	.. "	5 "	3 "	30	30.30	4,227.23	64

Speed on engine obtained by use of Boyer Recorder.
Main reservoir capacity, 75,000 cu. in.
Main reservoir pressure (brake valve running position) 100 lbs.
Main reservoir pressure (brake valve lap position) 140 lbs.
Average piston travel on cars, 6.78 in.
Grade, level.
Weather, good.
Condition of rail, good.
Size of pump, 8½ in. cross-compound.

*After 10 lbs. reduction from 80 lbs.

Description of Locomotive used in above demonstrations:

Consolidation, Class C—$57^{22}/_{30}$ 187.
Number—S. P. 2765.
Total weight of locomotive, loaded, 208,000 lbs.
Weight on drivers, 187,000 lbs.
Tractive power at 10 miles per hour, 43,305 lbs.
Locomotive equipped with 9,000 gallon rectangular tender.
Weight of tender, loaded, 170,500 lbs.
Weight of locomotive and tender, loaded, 378,500 lbs.

tained with the same train during the running tests which are illustrated by tabulated data and graphical curves.

A series of runs were made on a practically level track between Puente and Bassett, Cal., at different speeds, with the 80-car train of empty oil cars, fitted with the different combinations of air-brake equipment, first with the all Type H (standard quick action) triple valves; then half H and half Type K (improved quick service) triple valves; then with the Type K.

The Westinghouse dynamometer car, containing instruments for accurately recording the speed, length of stops and pressures was the 24th car in the train.

The locomotive was fitted with Boyer speed recorder and special pressure gages for guiding the engineer as to the results desired.

Telephones were installed in the locomotive, dynamometer, 50th and 80th cars and a three-wire cable run throughout the train for the electrical connections to the recording instruments and telephones.

Combination speed-distance curves have been plotted from the data collected during this series of demonstrations, which graphically illustrate the comparative effectiveness of the standard and improved equipment in the lengths of the stops from the various speeds with 5, 10, 15 and 20-lb. brake-pipe reductions.

An examination of the curves on Fig. 9 showing results of light brake applications will bring a better appreciation

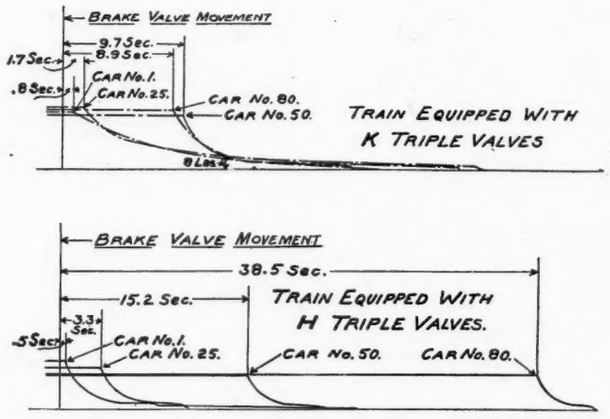


Fig. 8—Uniform Release Demonstration. Composite Brake Cylinder Diagram.

The most important point in handling freight trains is to secure the best control with the lightest permissible brake application, i.e., the least possible shock to equipment and lading.

AIR CONSUMPTION COMPARISON—TRAIN AT REST.

To determine the amount of air required by the standard and K triple valves to do the same amount of work, as might be represented by stopping the train in a given distance, two 1,700-ft. stops were selected from the runs made with each type of triple valves.

A brake-pipe reduction was made equal to that made during the stop selected, the brake-valve handle placed in release posi-

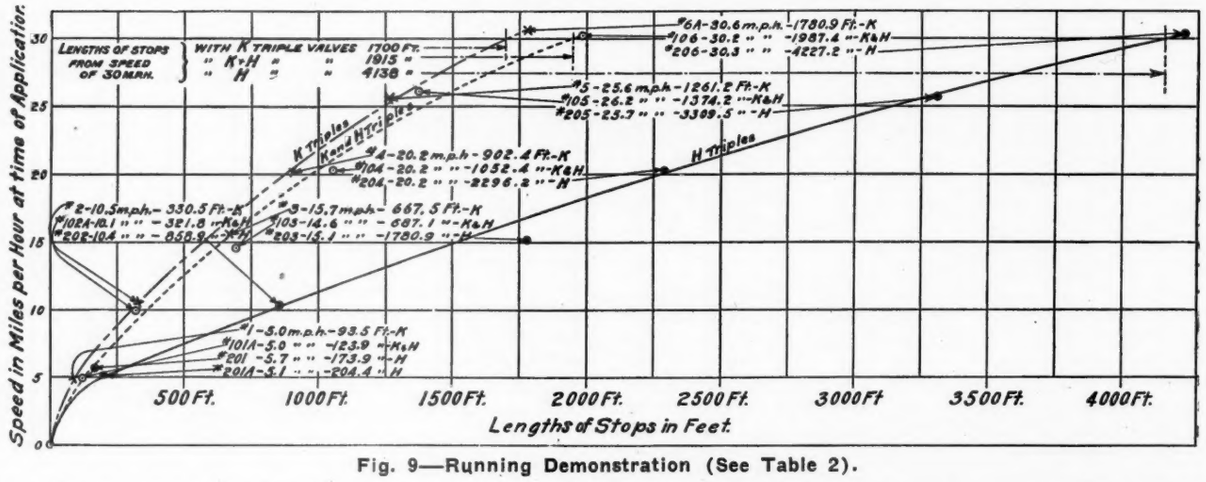


Fig. 9—Running Demonstration (See Table 2).

of the effect the K triple valves have on valves on adjacent vehicles and the effect in stopping power of applying all brakes in a long train and applying them in the shortest possible time.

MEDIUM SERVICE APPLICATIONS.

Fig. 10 further illustrates the effect of securing the higher effective pressures during the earlier part of the stop.

It will be readily seen that the trains can be controlled in the distances with light applications with the improved equipment that have taken heavy applications heretofore to secure and as the end desired with service applications is smoothness and time, freight trains are always on short time, the K triple valves avoid the necessity for heavy or emergency applications and the saving in damage to lading en route is beyond estimate.

HEAVY SERVICE APPLICATIONS.

Fig. 13 is of more than ordinary interest as further illustrating the necessity which existed for making heavy brake applications to control trains before the development of the K triple. With 15-lb. brake-pipe reductions the stops have been shortened with the standard equipment considerably but the stops with the K triples are about where they were with the lighter 10-lb. applications and the observers present were conscious of the increase in shock with the heavier applications with standard equipment.

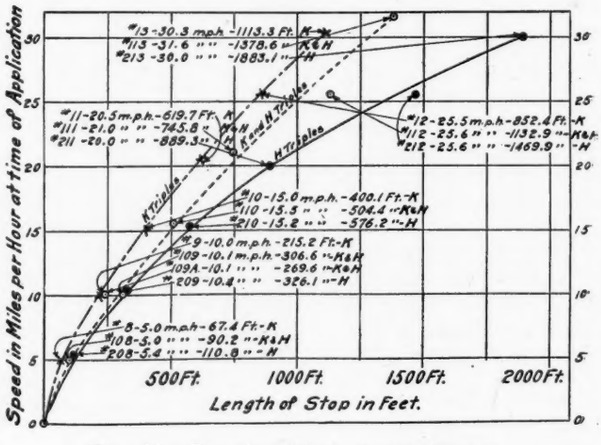


Fig. 10—Running Test; Quick Service.

tion until recharge was completed as indicated by the pressure gages on locomotive and on auxiliary reservoir of rear car, and it was found that the H triple required 474 single strokes while the K triple required only 122 single strokes.

The number of single pump strokes required to recharge to the original main reservoir pressure of 80 lbs. were counted.

This comparison is important not alone from the money value of air economy itself but for the much more important consideration of controlling the train on grades and elsewhere with the least possible necessary deduction from the

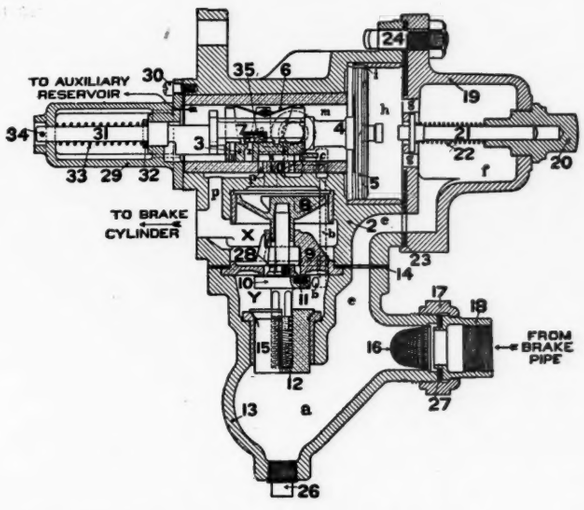


Fig. 11. Type K Triple Valve. Sectional.

stored volume as in this way will be left the greatest reserve factor of safety.

RUNNING APPLICATION DEMONSTRATIONS—QUICK SERVICE FEATURE.

Comparative stops from 15, 20, 25 and 30 miles per hour with the different brake-pipe reductions.

Fig. 14, showing graphically the comparative stops from all speeds and reductions, will permit ready observation of the results of the running demonstrations made with the 80-car empty train.

It will be of special interest to note the work done with the light brake applications by the K triple valves as against the much longer diagrams from the light applications with the standard triple valve.

Probably the most remarkable result is the stopping of the train with the K triple valves in 1,700 ft. from 30 miles per hour with 5-lb. brake-pipe reduction as against 4,138 ft. with the H valves and the requiring of a 20-lb. brake-pipe reduction with the H valves to stop the train in 1,700 ft.

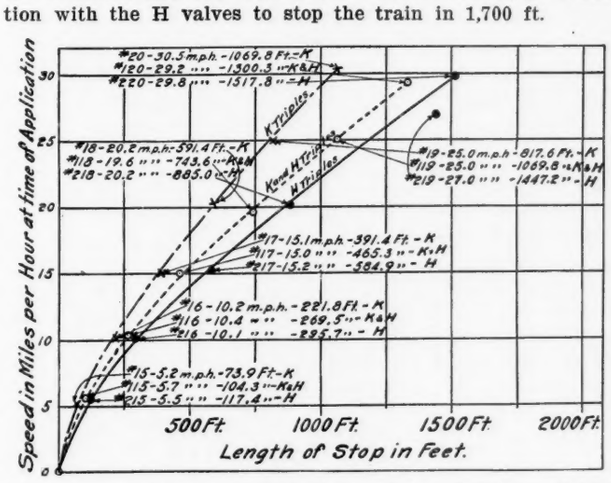


Fig. 13—Running Demonstration. Quick Service. Heavy Application.

RUNNING UNIFORM RELEASE TEST.

After the completion of the running tests with the 80 empty cars a special demonstration was made with 50 of the same oil cars, 25 of them loaded and 25 empty, loads ahead, to note the results in service of the uniform releasing of the brakes with the K triple valves.

The loads were placed ahead to magnify the effect of slack running out as brakes released on front cars, the loaded cars having the lowest per cent. of braking effort. In other words, to represent maximum conditions.

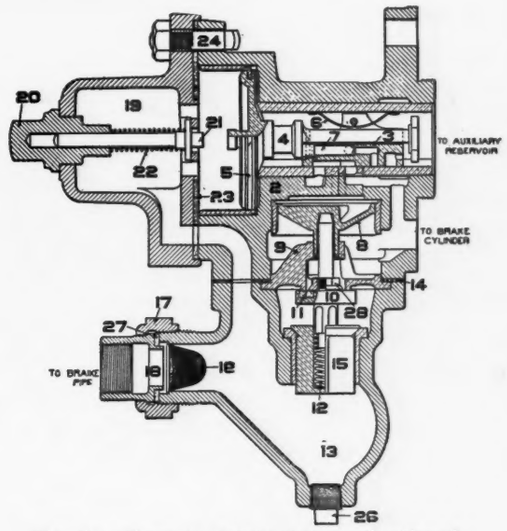


Fig. 12—Type H Triple Valve. Sectional.

The train was accelerated to 21.4 miles per hour when a heavy brake application was made and held until the speed had been reduced to 7.25 m.p.h. when the brakes were released and engineer applied steam with full throttle.

The result was simply a steady increase in drawbar pull, no jerk, and train was put under headway without stopping and without any internal shocks whatever.

This demonstration illustrating the uniform release feature of the K triple valve which, in its far reaching importance in freight train handling to the operating department, is almost if not quite equal in value to the quick service feature.

TONNAGE HANDLING DEMONSTRATION.

Service demonstrations of operation of improved air-brake equipment in operating heavy trains on 2 per cent. and 3.7 per cent. grades were made by handling tonnage trains from Beaumont to Palm Springs, Siskiyou, to Hornbrook, and Siskiyou to Ashland.

These demonstrations were to show the increased tonnage which may be safely handled by the use of "K" triple valves.

Records were made of the make-up of train, also the empty and loaded weight, kind of lading, type of triple valves, size of brake-cylinders, percentage of braking power of the empty cars, percentage of braking power on entire train, number of brakes cut in and operative in yard tests, and detailed record of equipment installed on locomotive and tenders.

Before starting on the descending grade, the brakes were tested, leakage reduced to a reasonable amount, and piston travel adjusted. The preferred piston travel was 7 in., with a permissible variation of between 6 in. and 8 in.

Records were made of all defects found and not corrected.

The dynamometer car was the first car in the train. A 150-lb. recording gage was installed on this car and connected with the main reservoir pressure on the locomotive for the purpose of obtaining a continuous record of fluctuations of main reservoir pressure.

The chronograph recorded the following: Actual speed of train at all times during a run; movement of brake-valve into and out of lap position and fluctuations of brake-pipe pressure.

The chronograph operator made notes on the chronograph record of mile posts and other prominent landmarks as they were passed.

A gage was connected to the brake-pipe on this car and an observer made record of the fluctuations of brake-pipe pressure, giving maximum and minimum pressures as the changes occurred.

The 20th and rear cars were each fitted with three recording gages; one to be connected with the brake-pipe; one with the brake-cylinder and one with the auxiliary reservoir, the purpose being to obtain a continuous record of the fluctuations of these pressures.

The actual number of operative brakes and their effectiveness was determined by the thermal test. The ratings for wheel temperatures were cold, warm, normal and hot.

"Normal" was the approximate average temperature of wheels throughout the train and all other classifications specified were relative to this. When the chill only was off from wheels, they were considered cold. Three cars having warm wheels were considered as one good brake.

BEAUMONT TO PALM SPRINGS.

With 2 per cent. grade, standard tonnage rating 4,000 ms. per train, 110 ms. per brake, the maximum tonnage handled during this demonstration was 6004.8 ms.—182.8 ms. per brake.

On Fig. 15 is given a graphical representation of the results of Demonstration 504 which was made with 39 loaded oil cars class 0-50-2, also dynamometer car and caboose from Beaumont to Palm Springs, Cal.

The cars were fitted with K triple valves and standard 15-lb. retaining valves.

Demonstrations had previously been made to represent ordinary operating conditions with some increase in ms. per brake with the standard train tonnage of 4,000 ms.

Demonstration 504 was made to show the remarkable benefit to be derived from the use of the quick service, uniform release and uniform recharge features of the K triple valve in handling increased tonnage on grades.

It will be noted that the train tonnage was raised to 6,000 ms. total, a 50 per cent. increase, and the ms. per brake to 167.5 at the start, then to 177.5 and finally to 182.8, or approximately 65 per cent. increase.

Reading from the bottom of the page up on Fig. 15, are shown for ready observation the mile posts, the curvature of track, profile from Beaumont to Palm Springs with per cent. of gradient at frequent intervals, speed of train in miles per hour and time brakes were applied and released.

This chart has been arranged particularly to permit observation comparatively of the important points brought out in the demonstration which in the order of their importance are as follows, total tonnage, ms. per brake, maintenance of auxiliary reservoir pressure, the light average of brake-pipe reductions and the perfect control of train as indicated by the speed diagram.

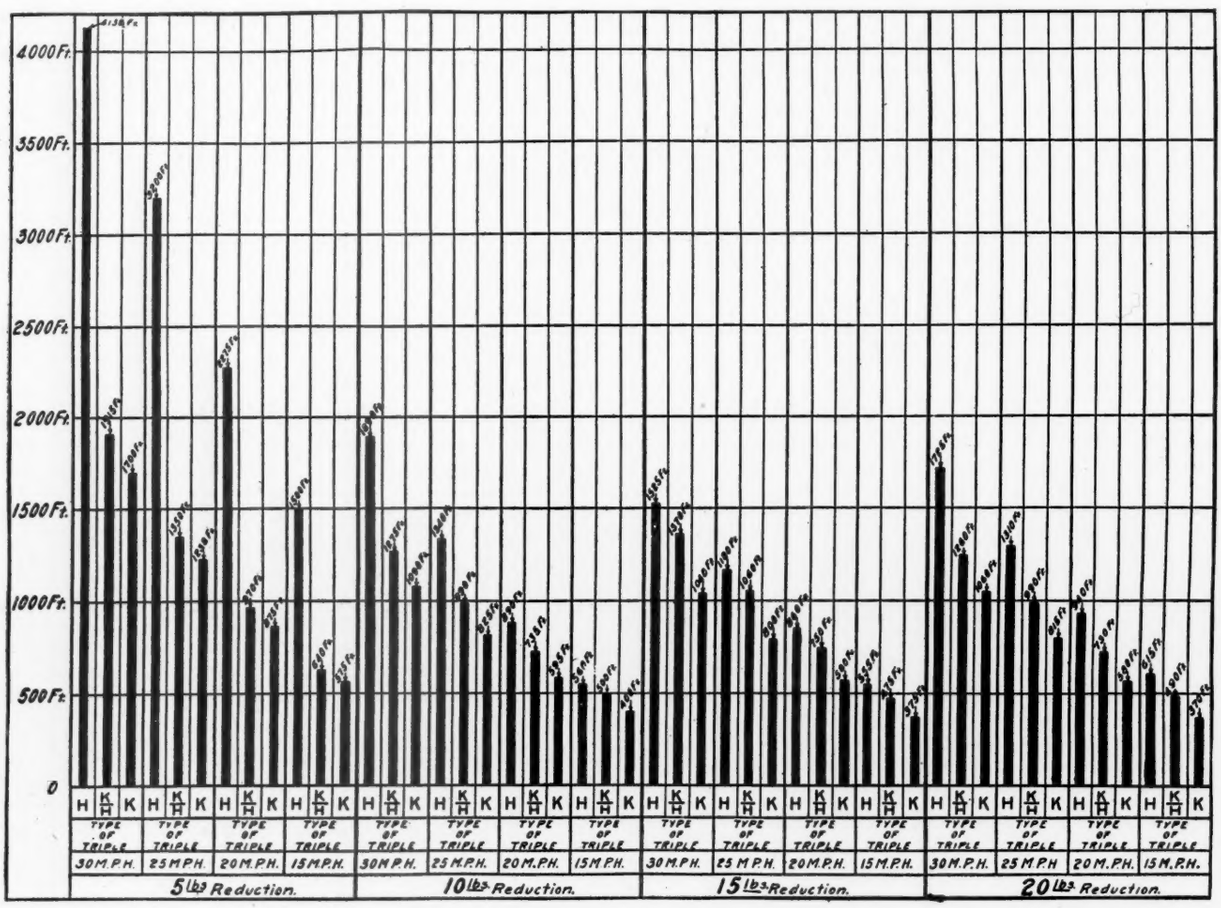


Fig. 14—Lengths of Stops from Different Speeds with K, K & H, and H Triple Valves, 5, 10, 15 and 20-lb. Brake Pipe Reductions.

It will be seen that the brakes were off more than they were on and at no time was there an indication of using any of the ample reserve stored volume.

The pressures were maintained as completely as with normal tonnage.

TONNAGE TEST—SISKIYOU TO HORNBROOK.

Distance, 17 miles; maximum grade, 3.3 per cent. Standard tonnage rating for this grade, 2650 ms. per train; 80 ms. per brake. Maximum tonnage handled during demonstration 132 ms. per brake.

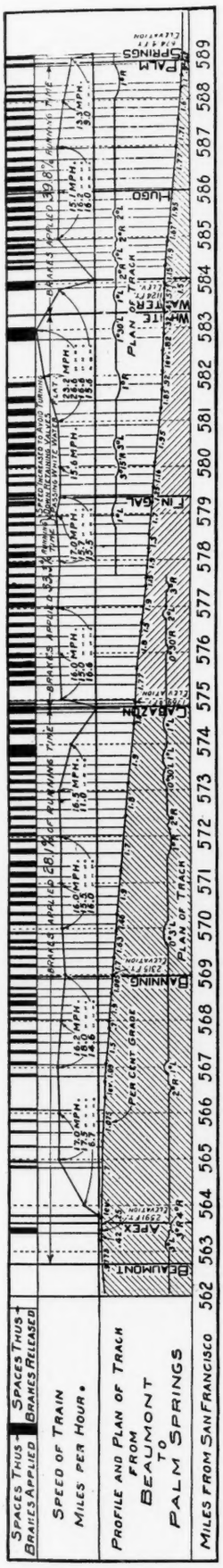


Fig. 15—Tonnage Chart, Train of 39 Loaded S. P. Co. Class 0-50-2 Oil Cars, Dynamometer Car and Caboose. Westinghouse Improved Brake Equipment.

From Beaumont to Palm Springs, Cal., July 16, 1908. Total weight of train behind engine, 6,004.8 Ms. Tonnage per good brake, 182.8 Ms.

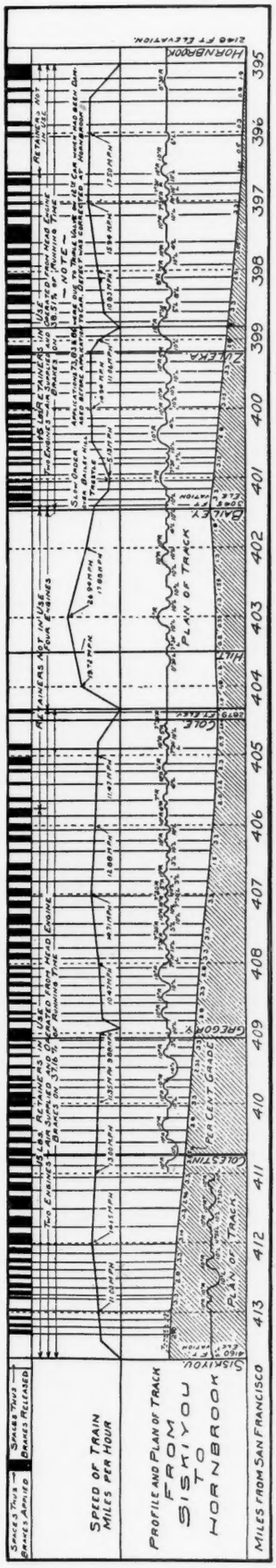


Fig. 16—Train of 17 Loaded and 2 Empty S. P. Class B-50-2 Box Cars, Dynamometer Car and Caboose. Westinghouse Improved Brake Equipment.

From Siskiyou, Ore., to Hornbrook, Cal., Aug. 19, 1908. Total weight of train behind engine, 2,681.65 Ms. Tonnage per good brake, 132.58 Ms. 90-lb. brake-pipe pressure.

Fig. 16 illustrates graphically run No. 9 for ready observance of the points of interest brought out.

Reading from the bottom of the page up are shown the mile posts, the curvature of track, the profile from Siskiyou to Hornbrook with per cent. of gradient at frequent intervals, speed of train in miles per hour, and comparison of time brakes were on and off.

The perfect control of the train and maintenance of the air pressures at the proper point to preserve a satisfactory factor of safety illustrates the value of the K triple valve for permitting the handling on this grade of heavy capacity cars with maximum load without the necessity of arranging for light loads or empties being switched into the train to lower the ms. per brake to the present rating.

In other words, the K triple valves would permit handling the freight traffic over Siskiyou mountain just as it reaches the foot of the grade.

TONNAGE DEMONSTRATION—SISKIYOU TO ASHLAND, ORE.

Distance, 17 miles; maximum grade, 3.3 per cent. Standard tonnage rating for this grade, 2650 ms. per train, 80 ms. per brake. Maximum tonnage handled during demonstration, 145 ms. per brake. The "work done" by the K triple valves, as graphically illustrated in Figs. 15 and 16, while of great value and importance, is only secondary to the real reason for the development of the K triple.

The quick service for cutting down the time of serial action of the brakes through long trains in service application, and the uniform release to permit engineers to release the brakes on freight trains at any time instead of completing the stop, as now required, were designed for general train handling to cut down the damaging shocks to equipment and lading, but the effective use of all the brakes in the train in less than half the time heretofore required, together with the benefits of the other improved functions of the K triple valve, made it immediately possible to control trains both long and short with greater facility with less deduction from the stored volume of pressures, hence the possibilities for the smoother and easier control of long trains and the immense benefit accruing from the better control of heavier short trains on grades.

COMPARATIVE AIR PUMP DEMONSTRATION—ECONOMICAL AIR SUPPLY.

Powerful locomotives, with the ability to handle very long trains and heavy tonnage trains on grades, have increased the demands for compressed air on freight trains to such an extent that greater pump capacity has become essential.

With the greater capacity pumps the subject of steam consumption is very important as the cost per annum of operating a large compresser on a loccmotive is enough to make it well worth while to apply a pump which requires the least steam per 100 cu. ft. of air output.

Tests show that the Westinghouse improved 8½-in. cross compound pump delivers 3.87 cu. ft. of free air for each pound of steam consumed, or about double the amount obtained from an ordinary simple pump. This excellent result is brought about with the Westinghouse pump by compounding both the steam and the air cylinders.

It will be of more than ordinary interest to note that the Westinghouse pump delivered 3.87 cu. ft. of free air for each pound of steam consumed as against only 1.88 cu. ft. of free air for each pound of steam delivered by the New York No. 5 pump, or a gain in favor of the Westinghouse compressor of 105.8 per cent.

In other words, the New York No. 5 air pump requires over twice the amount of steam to pump 100 cu. ft. of free air than the Westinghouse 8½ in. cross compound pump requires.

This excellent result is brought about in the Westinghouse pump by compounding both the steam and the air, thus securing a very large output of free air for a small steam consumption.

It is calculated that on a locomotive of the class that would require a large air pump of this character, the saving ef-

fected by the Westinghouse pump as against the New York No. 5 would purchase a Westinghouse 8½ in. C. C. pump in less than two years' time.

RUNNING FREIGHT TESTS—CHRONOGRAPH RECORD OF COMPARATIVE RELEASE PRESSURES.

During all the tonnage demonstrations on Beaumont and Siskiyou grades, the dynamometer car was the first car back of locomotive, and the chronograph was used to show variations of main reservoir and brake-pipe pressures, as well as to record speeds, landmarks, brake-cylinder pressures, etc.

In Fig. 17 is shown a tracing of the interesting records made during run 3 on August 11, and run 5 on August 15, 1908, on Siskiyou grade, which are characteristic pressure lines, showing the variation of main reservoir and brake-pipe pressures during release of brakes with two types of brake-valves on locomotive.

The New York Air-Brake Company's brake-valve, controlling brake-pipe pressure through the setting of the low-pressure governor, the brake-valve handle being carried in full release position, whereas the Westinghouse Air-Brake Company's brake-valve controls the brake-valve pressure through the setting of the feed valve permitting excess pressure to be carried in the main reservoir.

It will be of special interest to note that the main reservoir

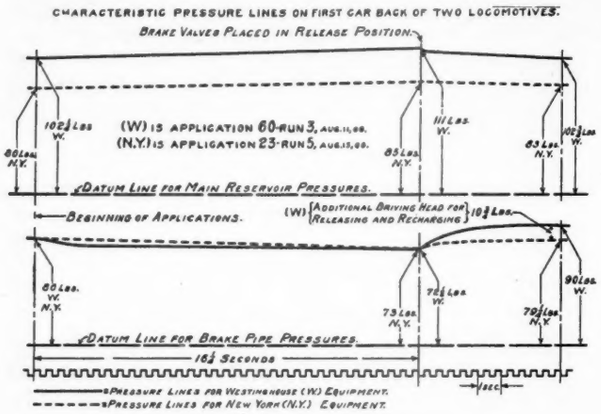


Fig. 17—Running Demonstration.

Chronograph record showing comparative pressures obtained for releasing brakes with Westinghouse and New York brake valves.

pressure carried with the Westinghouse equipment was 102¼ lbs., reaching 111 lbs. just prior to the placing of brake-valve handle in release position, as compared with 85 lbs. carried at this point with the New York equipment.

The comparative rise in brake-pipe pressure, as shown in lower portion of plate, resulting from this advantage of having 20 lbs. excess main reservoir pressure at time of release with the Westinghouse brake-valve, shows an additional driving head of 10¾ lbs. in brake-pipe six seconds after release.

The advantage of having extra driving head in brake-pipe is very important when considered with placing K triple valves in uniform release position and securing prompt release of brakes on rear cars and prompt recharge of all auxiliary reservoirs.

Many break-in-twos and slid flat wheels, as well as inefficient brakes on rear of trains occur from lack of driving head during release of brakes.

FREIGHT EQUIPMENT SUMMARY.

The results of the different series of tests shown on the preceding pages fully demonstrate the existence of the improvements and refinements in the K triple valve, and have also illustrated the necessity for these improvements by showing the results which are ordinarily secured from the use of standard equipment, and have also shown the benefits to be derived from the use of the improved equipment, as follows:

First.—That with all brakes applied with light reductions, trains can be controlled with the K triple valves with less shock to equipment and damage to lading en route.

Second.—That the control of trains with light reductions secures greater reserve in the air-brake equipment with K triple valves, as several light reductions can be made from the same stored volume as would be required for one heavy application to secure similar control with standard triple valves. This means much in the handling of increased tonnage on grades.

Third.—The quick service feature of K triple valves favorably effecting other triples, whatever their type on adjacent vehicles, makes it possible to secure improved results with only a partial equipment of K triple valves, securing the improved results in proportion to the number of K triple valves in the train, plus the advantage secured from the favorable effect upon the other adjacent triple valves.

Fourth.—The uniform release feature of the K triple valve, making it possible to secure uniform and prompt release of all brakes in the train and reducing shocks to equipment and damage to lading, is of great importance, even though engineers were not permitted to release brakes at any and all times, as whenever a release is made with the K triple valves there is much less shock to the equipment and lading.

Fifth.—By the use of the K triple valves the same air supply capacity on locomotive will serve for longer trains than with standard equipment.

Sixth.—The combined benefits of the ET locomotive equipment and K triple valves in securing prompt release of all brakes in the train is of great importance as bearing upon the reduction of the number of break-in-twos and slid flat wheels.

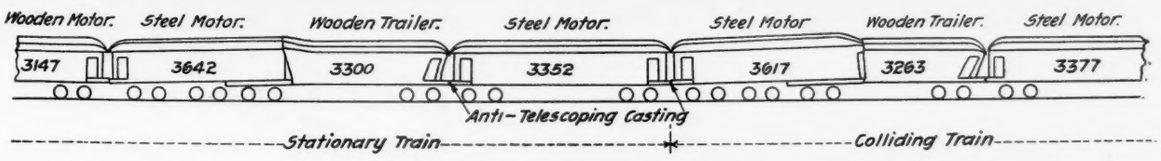
(To be continued.)

HEDLEY ANTI-TELESCOPING DEVICE.

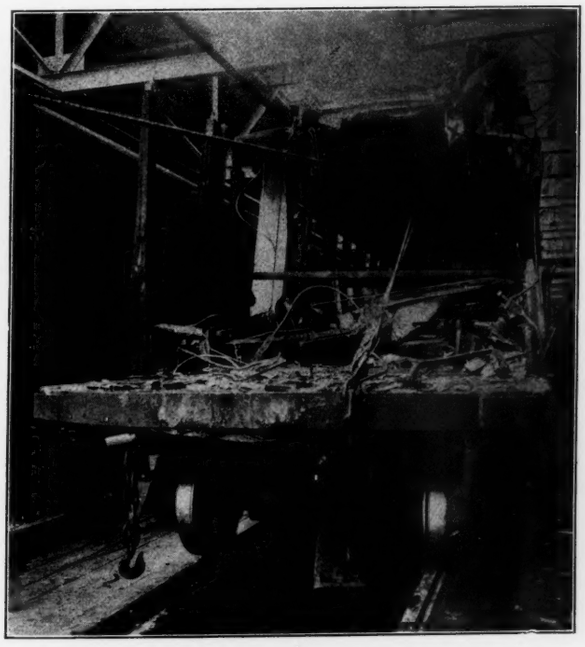
The damage resulting from a collision on the Westchester branch of the subway division, Interborough Rapid Transit Co., New York City, is shown in the accompanying illustrations. No passengers were in the cars at the time, as the trains were being switched preparatory to laying-up for the night. The collision occurred about 8 p.m. on December 4 of last year. An eight-car train, containing four steel motors, one wooden motor and three wooden trailer cars collided with a stationary eight-car train, containing three steel motors, two wooden motors and three wooden trailer cars. In a letter to the General Manager in connection with this collision the Superintendent of Car Equipment said that a noticeable feature of the accident was the effectiveness of the anti-telescoping device, which apparently prevented the rear and forward motor cars of the colliding train from telescoping. The line cut herewith shows the positions taken by the cars and reference to the respective half-tones gives an idea of the damage to the cars. It will be noticed that car No. 3,352 was equipped with the anti-telescoping device, which undoubtedly kept it from being telescoped by, or itself telescoping, car No. 3,617 of the moving train, which was not thus equipped. It seems that the jaws of the device took sufficient hold on the surface of the plane buffer to prevent the cars from rising. Close inspection of the front end of car No. 3,617 ought to justify this statement. The total approximate damage sustained by three cars of the colliding and four cars of the stationary train was $8,791. Cars No. 3,300 and 3,263 received the greatest damage, being wooden trailers, telescoped by steel motor cars. The total approximate damage to these cars was $5,496, this amount being about equally divided between them. The least damage was sustained by cars Nos. 3,147 and 3,377, being less than $50 in each case. A marked contrast is shown in the two photographs of car No. 3,617, opposite ends. This car, as previously noted, had plane buffers, but the forward end was held by the anti-telescoping device on car No. 3.352, while the rear end, which telescoped car No. 3,262, even

Front End of Car No. 3617; Steel Motor.

Rear End of Car No. 3617.



Positions Taken by Cars After Collision.

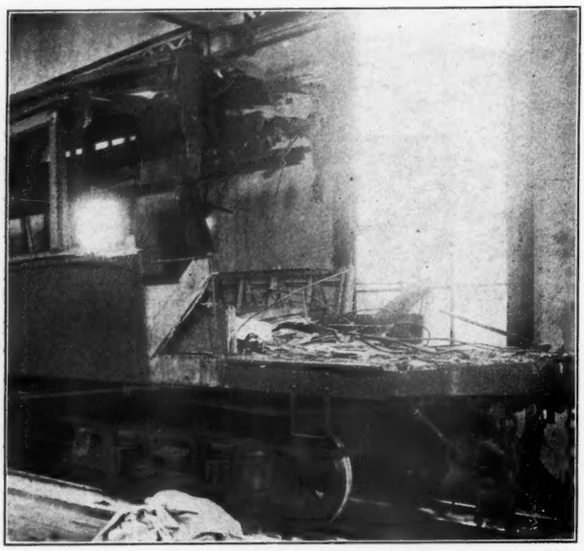


Car No. 3263; Wooden Trailer.

Car No. 3352; Steel Motor.

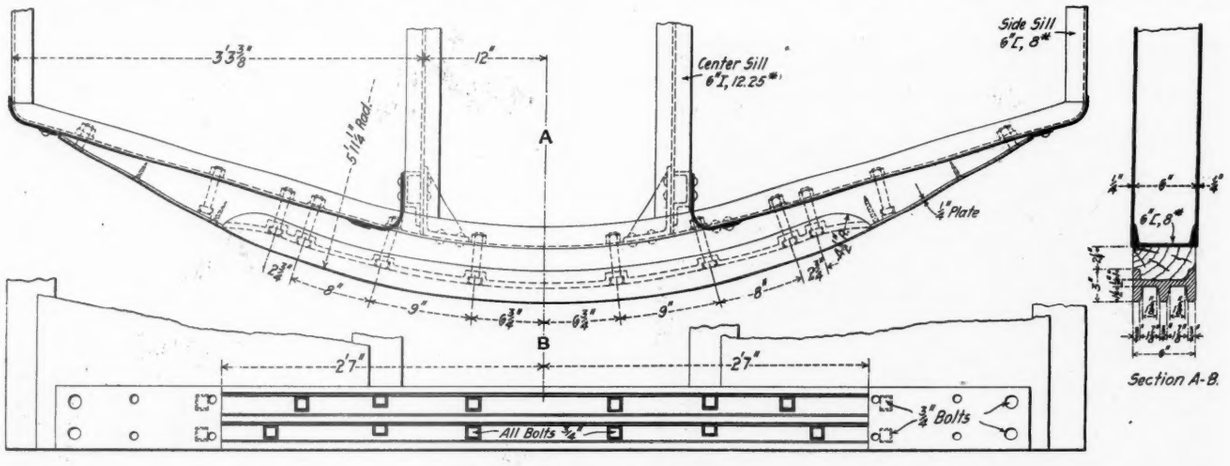
though the latter was a wooden car, was damaged to the amount of about $1,500.

The Hedley anti-telescoping device, as the name implies, is designed to prevent that feature of collisions which is the source of the greatest damage. If it is possible to prevent the meeting cars from rising above the horizontal plane of their center sills, telescoping cannot result, as the force of the collision is taken by the underframing of the cars. When either of the cars does rise above this plane there is no



Car No. 3300; Wooden Trailer.

way to prevent its forcing its way through the other car. This anti-telescoping device is designed on this principal and its effectiveness is apparent in the results of this collision. It is either a steel casting or rolled section, and as is seen in the illustration, is of I-section on the side which is mortised into the wooden buffer timber, and has three teeth on the outer side. The verticle surfaces of these teeth form the chafing surface. The castings on adjoining cars do not mesh together unless one of the cars should rise above its normal



Hedley Steel Buffer Casting.

height, which is usually the case in a collision. In this event, there can be an upward movement of but ¾ in. before the castings mesh together. Further upward movement can result only by both car bodies rising together, in which no serious damage can result. The casting on the steel subway cars is fastened with ¾-in. bolts extending through the buffer timber and the 6-in. channel section, which latter lies between two steel cover plates. This method makes the device practically a part of the steel underframing of the car. As the castings extend 2 ft. 7 in. on either side of the horizontal center line of the car, the castings are always in contact, even on the smallest curves. Forsythe Bros., Chicago and New York, have the sole right to manufacture this anti-telescoping casting.

RAILWAY NATIONALIZATION.*

BY SIR GEORGE GIBB.
Managing Director, Underground Electric Railways Company of London.

Railway Nationalization has for many years occupied the minds of economic and political students and the practical activities of statesmen in many countries and in English colonies. It has been regarded here (England) as a remote possibility which might some day or other come to the front for practical discussion. But quite recently it would have been thought to be as incredible that any responsible politicians should be considering proposals for purchasing our railways for the state as that any substantial number of persons could be found who would advocate an abandonment of the fundamental principle that there should be no taxation of imports into England except for revenue purposes. In these days, however, public opinion moves suddenly and rapidly. The despised fallacy of yesterday rises as the creed of to-day. There are already many indications that, before long, there will be a numerous and influential, though perhaps a somewhat heterogeneous party, who will urge that immediate steps should be taken to nationalize our railways.

The test, and the only test, to be applied to proposals for railway nationalization is whether railways owned by the state and worked directly by government officials would be better and more efficient than railways owned and worked by private corporations, and whether, after taking account of all the effects of the change, upon each class, each district, each interest, the net result would increase the wealth and well being of the community, and be a permanent benefit to the public.

RAILWAY SHAREHOLDERS' INTERESTS.

We may, I think, start from the assumption that railway proprietors as such have no interest in opposing nationalization.

The value of their property, whether measured in terms of capital value or in terms of future income, estimated on a fair basis, would, it is assumed, be fully provided for in the gigantic financial operation which railway purchase would involve. There is no legal flaw in the title of railway proprietors. They enjoy the fundamental rights attached by our law to absolute property, subject only to the performance of

*A paper read at a meeting of the Royal Economic Society, London, November 10, 1908, W. M. Acworth in the chair.

obligations definitely prescribed by Acts of Parliament. I think, therefore, that we may discuss this subject of Railway Nationalization without apprehension that the change, if it were adopted by the deliberate judgment of the community, would be accompanied by anything in the nature of confiscation of existing rights.

SOCIALISTS AND NATIONALIZATION.

This might not be the intention or the wish of all who think that our railways should be nationalized. Probably some extreme Socialists would like to transfer railways to the state without giving what, in our judgment, would be adequate compensation to existing owners. Their aim is the substitution of a new social polity for that which exists, in which antiquated ideas of private property would have no place. But that is only a phase of their creed which condemns it to sterility. It is not the small band of Socialist zealots, but the majority of the nation that we have to consider in estimating the risk of anything being done in the nature of confiscation.

Those who join the party for nationalizing will, no doubt, find themselves in strange company. There can be little doubt that the movement up to the present has been mainly Socialistic. A trader, who advocates nationalization because he hopes that he might be able to transfer to somebody else, perhaps he does not very much care whom, some part of the burden of the charges which he has to pay for railway carriage, will find that his next neighbor at a meeting of the party, is a man who has joined for quite other reasons, with the object, indeed, of ultimately seizing for the state some part of his neighbor, the trader's, property, which the latter was reckoning to increase at the expense of, amongst others, his neighbor the Socialist, through the plan of railway nationalization. But the homogeneity of the party need not concern us, nor the question whether each and every member of it would be actuated by a single-minded desire for the public good. The forces making for honesty and equity in the treatment of existing interests would, I think, so overwhelmingly outweigh the influences tending in a contrary direction that we need not complicate the question by importing into it a discussion as to whether adequate compenstion should or would be paid to existing owners in the event of the state deciding to acquire their property. Fair and adequate compensation for existing interests may be taken for granted.

But although compenstion can be paid for property, it cannot be paid to the general community who would suffer in the event of the administration and operation of railways under state management. If a mistake be made, all would suffer, and their sufferings would not, and could not, be mitigated by compensation in any form.

ORIGIN OF THE NATIONALIZATION MOVEMENT.

It may be useful at the outset to consider what has led to the question of railway nationalization in this country being discussed.

The origin and the causes of those movements in public opinion which bring about great constitutional and social changes are frequently most difficult to trace, especially by contemporary observers. For a full understanding of such movements it is necessary to wait for the historian's point of view, and to survey a wider field than is possible whilst the events are occurring, when much of the material for final judgment as to the causes in operation is concealed in an undisclosed future.

That there is a movement in progress tending to the nationalization of railways in England is apparent to every thoughtful observer of the signs of the times. But whence does this movement come, and what are its principal causes? We are able to identify some of them, less able to weigh the relative importance of each, still less able to foretell the ultimate share which each will have on the future course of development, which will depend on the direction taken by other movements in public opinion which, at the moment, may seem to be entirely independent of all connection with the particular movement we are considering.

SOME CAUSES OF THE MOVEMENT IN ENGLAND.

I will refer to a few of the causes which seem to me to be most prominently at work, but I will not attempt to state them in the order of their importance. I will merely enumerate those which are plainly discernible.

The first I will name, though it may not be the most influential, is the existence of a certain amount of dissatisfaction with the present state of railway administration. I suppose that if railway services were as good as possible, charges as cheap as possible, profits as high as possible, and the management as perfect as it is possible for railway management to be, and these conditions are generally admitted to exist, the natural instinct to leave well alone would prevent any proposal for nationalization from obtaining a hearing.

It must be conceded that there is a certain feeling of dissatisfaction, superficial and indefinite though it be, to which advocates of nationalization, whose schemes originate in considerations which have no relation either to the excellence or to the imperfections of railway arrangements, are liable to appeal to the pursuit of their aims. It is not that many people really think that our railways do not, as a whole, serve the public well, whatever individuals may say in moments of haste. But complaints are sufficiently numerous to have a real importance as an influence on public opinion. And, unfortunately, their influence is, to a large extent, independent of their justice. The existence of criticism, which, after all is only another name for difference of opinion, is inevitable, and probably would be inevitable under the most perfect system of railway management which the world has seen or ever can see. State railways would not be immaculate. The nature of railway business lays it open, to an exceptional extent, to the popularity which unavoidably gathers round every institution on which there is universal dependence. Providence itself does not wholly escape unpopularity. No other industry is comparable with the railway industry in the close dependence upon it of the vast majority of the people. The necessity for transport services penetrates more frequently and more deeply into the lives and habits of the people than any of the other prime necessities of civilization. The need for transport is a tyranny. All tyrants are unpopular, and the tyranny of a need is apt to beget, by an illogical transposition of ideas, a dislike of those who are responsible for supplying the need. People are conscious of grievances, or, let us say, unsupplied wants. They cannot measure the range of possibility which limits the supply of those wants or remedies for those grievances. They constantly wish for the impossible, but have not sufficient knowledge to distinguish between the possible and the impossible. Defects which cannot be remedied are generally condemned with more emphasis than those which are due to mismanagement. It is irrelevant to consider whether the dissatisfaction to which I have referred is justified or not. Whether well or ill founded, it must be set down as one of the causes of the movement for nationalization.

WANT OF EFFECTIVE CONTROL.

The second cause I would mention is a belief growing from a suspicion into a conviction under the stimulus of repeated failures in control experiments, that it is impossible for any government, by any legislative or executive action in any form to exercise useful and effective control over railways. People turn in despair from ideas of regulation and control to ideas of ownership.

DISTRICT JEALOUSY.

The third cause is the prevalence of that feeling which for want of a better name I shall call district jealousy. The competition of privately owned railways undoubtedly does create inequalities. It would be mere affectation to pretend that the railway accommodation and facilities afforded to all places and all districts are equal in merit and value. The less

favored districts see other districts enjoying superior facilities. They do not allow for differences in conditions which, in some cases, explain and justify the differences of service. I say in some cases, because it would be impossible to deny that in other cases the comparative inferiority of railway facilities cannot be explained away by inevitable determining conditions. Hence district jealousy arises and a desire for uniformity, such uniformity as it is hoped a state system of railways would give.

FOREIGN EXAMPLE.

The fourth cause I would name is the example of other countries. This is affecting men's judgments with great force. We are slow to be moved by foreign example. But there is an increasing tendency to submit to international influences, and foreign example in this matter does, on the whole, point to national railways becoming the generally accepted system.

SOCIALISTIC TENDENCIES.

The fifth cause is the one which, I think, has more to do with the initiation of the discussion of nationalization schemes than any other cause. This is the general tendency of the time to Socialistic experiments. If there were no Socialists, and no Socialism in the thought of the age, there would, we may safely conclude, be no talk of nationalization of railways. It is the Socialistic propaganda, and the influence which that propaganda has had on many minds, which more than anything else has brought the question of the nationalization of railways within the range of practical discussion.

MORE REVENUE FOR THE STATE.

The sixth cause is the anxious search for more revenue for the state. National expenditure has grown to such enormous and alarming dimensions that the provision of revenue to meet it has become a serious and urgent difficulty. A Chancellor of the Exchequer on the outlook for cash has not been able to resist the attraction of railways as a source of revenue for the state. He has noted the various influences at work which are tending to bring the question of railway nationalization to the front has looked with envy at the large revenue which Prussian railways yield to the state, and has at least gone the length of asking himself the question, within the hearing of reporters, whether he ought not to encourage and to take advantage of a state of opinion which might conceivably be worked upon so as to create a majority prepared to approve the principle of state ownership of what might be a highly lucrative state monopoly.

RAILWAY MILEAGE.

The mileage of railways open for traffic in the United Kingdom at the end of each of the last four decades up to 1907 is shown in the following table:

Year.	Mileage open for traffic.	Increase in 10 years.	Av'ge increase per annum.
1877.....	17,077	.....	.....
1887.....	19,578	2,501	250.1
1897.....	21,433	1,855	185.5
1907.....	23,108	1,675	167.5

The growth has been slow and decreases with each decade. It is probably true that the period of construction has nearly come to an end. Future additions to the mileage are not likely to be either large or of substantial importance. This rather indicates the present as a suitable time for considering a change of system. The considerations which are applicable to what I may call the age of construction are very different from those which become most important in the age of operation.

PRIVATE ENTERPRISE.

It would probably be accepted as indisputable that in a country like England, where capital is plentiful and enterprise active, the system of leaving the construction of railways to private enterprise is the best system.

Whatever may be thought as to the respective merits of private and public ownership, it cannot be denied that private enterprise does take more risk than any Government is likely to do, except under pressure of military necessities. The hope of gain is the strongest motive for enterprise, and this desire operates more strongly on the private citizen than it does on the State.

The growth of railway mileage during the age of construction in any country is promoted by the constant influence and moving force of those incentives which act on capitalists. The spur of competition is always in active operation. Then there are the very powerful professional influences which are constantly at work to induce capitalists to spend their money on works and enterprises which afford professional work, even if they do not subsequently provide dividends.

Theoretically, no doubt, railways promoted by private enterprise tend to the favoring of particular localities at the expense of other localities. Perhaps it is right that the stronger should grow at the expense of the weaker, but, at all events, it is inevitable. You cannot expect private competitors to think of anything but their own interests. And if this be so, you cannot expect from a system in which private interests predominate the same consideration of general design, from the point of view of the interests of the whole country, as from a system which places public in front of private interests.

It is difficult to deny that the miscellaneous and unequal activities of private enterprise fail in the absence of some central guidance to produce the best results so far as harmony and completeness of design are concerned. In England, railway construction has not been, as in America, almost entirely free from any public control. We have had the control, I think the most salutary and useful control of Parliament, so far as it has gone, both over location and capitalization. But it has not gone far. Although there has been a certain amount of control, there has been practically no guidance. The control, under the system of private bill legislation, has been very ineffectual, except as regards capitalization. It has been mainly negative; never constructive. All that Parliament could practically do was to prohibit the making of particular railways which aroused opposition from some land-owning or railway interests powerful enough to oppose and wealthy enough to pay the heavy costs of opposition. Private interests have been protected, but the general public interest has, in the main, been ignored.

But while conceding that it would have been a great advantage if the vagaries of private enterprise had been more restrained by some prudent, general guidance, I think that the chief public requirement during the age of construction is that as much mileage as possible should be constructed; and I submit, as a true conclusion on the point I am discussing, that, as regards the age of construction at all events, England has derived incalculable benefit from the fact that the railway system has been made by private enterprise. But the problem of working the railway system after it has been constructed is, I admit, essentially different from the problem of securing its construction.

THEORETICAL CONSIDERATIONS.

My subject is not one which admits of discussion, except on very general lines. Our views on it must necessarily be formed under the influence of the opinions we hold as to the legitimate functions of the State. It has been truly said that no country has ever adopted State ownership of railways from theoretical considerations. In each and every instance there are some practical reasons, based on military necessities or concrete and pressing economic conditions to meet which State ownership was accepted, not as a system desirable in itself, but as an expedient which, in the circumstances, was considered to be the best practical solution of difficulties which stood in the way of the satisfactory development of railways. But, while agreeing with this as a true historical statement, I doubt whether theory can be entirely excluded from a statement of the genesis of national railway systems. In a country where Individualist opinions prevail, as I think at the present time they do in England, no temptations, no pressure or circumstances short of extreme national emergency, would induce

people to face the evils which the Individualist knows must result from the intrusion of State action into matters of trade. This is theory, although those who are influenced by it may think that it is founded on practical experience. On the other hand, those persons who wish to secure trading profits for the State even at the cost of taking commercial risks, or who, when difficulties and obstacles arise in commercial development, resort to the powers of the State to overcome them, either by the imposition of taxes on the general community in the interest of a class, or by handing over to State officials the direction of an industry, instead of relying on the skill, self-reliance, enterprise, energy and character of the people, are Socialists at heart, whether they know it or not, and are actuated by the radical theory of a creed which, perhaps, most of them would disavow.

But after all, the question is not whether State purchase would be a step in the Socialist direction, but whether it would be a step in the right direction. Why should we change? Are we suffering from intolerable evils from which there is no other way of escape, or is there some great national benefit to be derived from the change?

THE CASE FOR NATIONALIZATION.

The general case for nationalization, as put forward by its advocates, rests on very few arguments, and it is not, I think, unfair to describe these as being mainly assumptions, the accuracy of which it is impossible to verify. I may summarize a few of these:

1. Government management would be more efficient and less costly than private management.

2. Government management would primarily regard the interests of the community and of the country as a whole, and the substitution of that condition for the existing system under which the interests of private trading concerns take first place in the thoughts and efforts of those responsible for management would have the effect of securing a more equal and more satisfactory development of the resources of the country, and, as one writer expresses it with more than the usual proportion of assumption in his statement, trade would be stimulated under equitable, reasonable and uniform systems of rates.

3. The change would result in the removal of most of the serious complaints made against the existing administration of railways.

4. Those who refuse to look upon the matter as mainly a commercial problem think and hope that new means would be found for the satisfaction of the social needs of the nation if the railways were at the disposal of the Government.

5. Experience of the economy resulting from large combinations in other industries is invoked in support of the proposal to get rid of the separate administrations of private railways. It is said that the advantage of production on the largest scale by a single corporation in place of production by a number of smaller units is being verified by the experience of nearly every important trade and industry. The principle has been recognized in the history of railway development in this country by the amalgamation of large numbers of small railways into the great railway systems which we now see, and it is argued that a further step should now be taken in the same direction. But a step involving the creation of so great a monopoly as further large amalgamations would involve, can only, it is thought, be safely taken by the State. In this country the largest railway system under one management is no greater than about 2,000 miles in length, whereas in the United States of America railway systems covering about 15,000 miles are now under the control of a single president and a board of directors. It is said, therefore, that modern methods of administration have made it feasible to direct the 23,000 miles of railway in the United Kingdom efficiently and successfully by means of one comprehensive organization, and probably if there is to be one organization there would be no difference of opinion that the single organization to own, control and manage the railways, must be the State.

THE PRINCIPAL OBJECTIONS.

Most of the principal objections are, I think, covered by the following list:

1. State management would be less efficient than management under private enterprise.

2. The extension of Government patronage, by placing at the disposal of Government such a vast number of appointments to lucrative offices.

3. The risk of political corruption, not only in connection with the exercise of patronage, but also in ordinary administration in the settlement of questions relating to charges, wages and services.

4. The danger that interested parties would, by political pressure, compel the State to expend public money on unremunerative services.

5. The contraction of the available field for private enterprise, and hence the weakening of the foundation of all individual and national progress.

6. The introduction of serious dangers in connection with labor disputes between the Government and the large body of railway servants.

The subject has not been sufficiently long under public discussion to make it easy to state fully the hopes of its supporters and the fears of its opponents. Probably both are exaggerated. If one examines the complaints made against the existing railway system, it is obvious that many of those must exist under any system, while some are the necessary accompaniments of every system into which competition enters. But if competition is discarded in favor of monopoly, it does not need argument to show that this merely means a change from the evils of competition to the evils of monopoly. No one would deny that each system contains inherent and characteristic evils. The evil of competition is waste; the evils of monopoly are stagnation and the restriction of freedom.

(To be continued.)

FRAME FAILURES.

BY C. G. ROMMEL,
Inspector, Baltimore & Ohio.

To no other part of the locomotive is more attention given than to the frames. A locomotive with a broken frame can be likened to a man with a broken leg, for neither one is good for anything until the break has been mended. We all know that knitting a broken leg is slow and tedious work; so also is properly knitting together a broken locomotive frame slow and tedious, as well as expensive, not only on account of the shop charges, but also on account of the length of time the locomotive is out of service, which during the busy season is a very important item.

It has not been much more than a decade since attention was paid to the heating surface, and as the weight of the locomotive was limited to certain figures on account of track and bridge conditions, the frame was allowed to suffer in order to get what was thought sufficient heating surface. It was also uppermost in the minds of a great many that a flexible frame, that is, one that would readily adjust itself to the inequalities of the track, was the ideal. The result was that a 2-8-0 class, cylinders 22 in. x 28 in., total weight about 170,000 lbs., of which 153,000 lbs. was on the drivers, was built with a frame of 4-in. x 5-in. section in the main rail, and 4-in. x 6-in. section over the pedestals.

The pedestal legs were tied by the cast iron thimble, long bolt arrangement, commonly called the pedestal binder. To further the flexible idea, the waist sheets were of light plates fastened with small, and very few in number, bolts to a light section angle iron, which, in a number of cases, was not fastened to the boiler; the theory was that this must be so in order to allow for the expansion. The fallacy of all these ideas is shown to-day by the prematurely grey hairs on the official heads of both the operating and mechanical

departments, and the heart-rending letters received by all concerned, demanding an explanation of the increased expenses and delays on account of broken frames.

With everyone on the alert many causes must be discovered. The flexible idea was all wrong, the section was not heavy enough, the waist sheets were too light, the pedestal binders did not bind, the track was too rough, and time is too short to enumerate the many other causes. In order to take care of the piston thrusts, inequalities of track and transverse stresses, the frame must be more rigid. To increase the section throughout on the older power was too expensive a proposition. Some other means must be employed, but on all the new power the frames must be made of a heavier section, so the locomotives building to-day have frames with section of 5 in. x 5 in., 5 in. x 6 in., 5 in. x 6½ in., 6 in. x 6 in., and even heavier.

To reinforce the frames on the old power, use was made of the boiler, the most rigid part of the locomotive. The different strains were transmitted from the frame to the boiler by means of heavy waist sheets fastened to substantial tee irons riveted or studded to the boiler at the upper end, and well bolted to heavy cross braces, substantially fastened to the frame at the lower end. The pedestal binder made way for the pedestal brace, which was fitted with ample draw, long toes and two or three bolts at either end. The transverse stresses were also taken into account and provision made for them by means of plate cross braces. These improvements were also incorporated on the new power.

With but few exceptions, on all types of locomotives, the failures always occur ahead of the main pedestal. On a 4-4-0 class with a single front rail the majority of the failures are in the front rail near the junction with the main frame. On the 4-4-2 and the 4-6-0 classes the majority of the failures are in the top main rail over the front pedestal. On the 4-8-0 class the failures are about the front and intermediate pedestals.

The failure of the pedestal legs can be traced back to a loose binder or badly fitting pedestal brace, defective weld if frame is of wrought iron, or had a previous failure about the same point, but it is the failures in the main top rail that are hard to account for. The theory of the writer is that the majority of these failures that cannot be traced to a defective weld are caused by transverse stresses. If the points where these failures usually occur are noted, it will be found that it is the most flexible part of the frame back of the cylinders. Take, for example, the 4-6-0 type. The failures on this class are usually in the top main rail over the front pedestal, generally just back of the front leg. Of course, the frames are rigid at the cylinders, and the front rails on this type are usually well tied together by a plate cross brace, on which is carried the main reservoir or driver brake cylinders. This brings the point of failure the first flexible point back of the cylinders, and being subject to constant transverse stresses caused by curbing, nosing, etc., there is a constant strain about this point, with the result that the metal is eventually fatigued and failure occurs. The writer is of the opinion that the counter-balance question has not been duly considered in relation to frame failures, especially those which occur in the front rail. We all know that an engine improperly counter-balanced will nose excessively, and as this nosing increases the transverse stresses are bound to increase.

To shop a locomotive, tear off the frames, send them to the smith shop for welding broken part and re-apply to the locomotive, was found expensive, unless the locomotive was due for classified repairs, and as the locomotive could not be continued in service with the frame broken, some means had to be devised to re-weld the frame while on the locomotive. The most common arrangement in use at the present time is the oil burner. Thermit, a welding composition, is also coming into use.

With the oil burner it is customary to cut out the broken part of the frame, dress the faces square, spread the frame apart by means of jacks so there will be pressure on the weld, and put in a piece equal to the thickness of the part cut out, plus an allowance for welding, which is usually ¾ in., after which a furnace is built around the broken part of the frame, and by means of the oil burner the frame is heated to about the fusing point. When the fusing point is reached, the frame is struck with a battering ram and drawn together with clamps, which had been applied before the heating started, and then allowed to cool slowly. At the best, this process is but a brazing one and cannot be as strong as a weld made under the steam hammer; still it is satisfactory from the fact that the locomotive can be kept in service. Often the brazing takes place on the outer edges only, and in a few days the frame will be broken again. The oil burner is used a second time. It has been found from experience that a frame heated slowly while being welded with the oil burner will give better results than one to which the heat has been applied quickly.

In order to prevent a repetition of failures, it would be well when a locomotive, with a frame which has been repaired by the oil burner or Thermit process, goes through the shop for classified repairs, to take the frame down, send it to the smith shop to have the re-welded part cut out, and a new section welded in. At this time the welds can be made under the steam hammer with more certainty of a perfect weld being made. Another good plan is to stamp frame at point of weld with not less than ½-in. stencils, the date weld was made, the station mark and the method used in making weld. The method could be indicated by a symbol, thus O would indicate that the oil burner had been used, T that Thermit had been used, and F for the forged weld. By this means the exact life of the weld and the most efficient method could be determined.

The material used in locomotive frames has always been the subject of much discussion. With some, cast steel is not to be considered on account of the liability of failure due to shrinkage strains, improper material, blowholes, etc. While this argument may have held good during the period when the casting of frames from steel was in the experimental stage it will not hold at the present time, for considering the improvements made by the cast steel manufacturers, there can be no doubt but what the cast steel frame will give the most satisfactory results.

When it is considered that the wrought iron frame is but a series of welds, the cast steel should appeal more strongly. The rails of a wrought iron frame being hammered from scrap, there is likelihood of seams, which may not show on the surface but will in time cause the rail to open like the leaves of a book. After the rails have been gotten out there are no less than 21 welds made on a frame for a 2-8-0 class locomotive. Though the welds may show good on the surface, there is the possibility of the weld not being good in the center, which is practically impossible to determine, except by service. A weld is usually considered as having from 50 per cent. to 80 per cent. of the efficiency of the solid section. A wrought iron frame, with the welds in the best condition, has but 80 per cent. efficiency of section at 21 points on a 2-8-0 type locomotive, while a cast steel frame has practically 100 per cent. efficiency of section at all points. The chances for failure are therefore greater with a wrought iron frame than with a cast steel.

Another point which should be taken into consideration when frame failures are under discussion is the tire arrangement on the driver wheels or the rigid wheel base. This is governed by the alinement of the road. A railroad with but few curves can satisfactorily operate its locomotives with flanged tires on all driver wheels, but a railroad with a large number of sharp curves should take into consideration the effect on the frames from transverse stresses due to curving before making all flanged driver wheel tires a standard, especially on the long rigid wheel base 2-8-0 type. The best tire arrangement should be determined by thorough investigation.

General News Section.

The Erie canal was closed to navigation at midnight on November 30; the Champlain and the Oswego canals were closed on November 15.

The Strang gasolene-electric motor car "Irene" was taken over the Chicago & Alton from Chicago on November 29 and is to be given a three weeks' trial on this line.

Warren S. Stone, Grand Chief of the Brotherhood of Locomotive Engineers, announced November 28 that a 12-story building would be erected in Cleveland as the headquarters of the brotherhood.

On November 27 one of the Illinois Central warehouses near the Union station in New Orleans was burned. The warehouse contained 100 carloads of hay and farm products, and the estimated loss is about $60,000. This is the third Illinois Central warehouse to be burned in this district within the last few weeks.

Colonel B. W. Dunn, Chief Inspector of Explosives for the American Railway Association, delivered a free, illustrated lecture to the railway men of Harrisburg on December 1. He showed by the use of lantern slides the proper way to handle explosives in shipment. Colonel Dunn is traveling over the entire Pennsylvania system delivering lectures of this sort.

An officer of the Canadian Pacific writes that reports that this road intends to electrify certain of its mountain sections are premature. In common with all American railways, this officer says, the Canadian Pacific is always on the lookout for new ideas, but its management believes that the use of electricity as a motive power has not yet reached such a stage as would warrant the adoption of it now on lines such as those of the Canadian Pacific, and nothing of this kind has yet been decided on.

Two cases in which the question of the constitutionality of the state railway commission law was raised were submitted to the Supreme Court of Washington on November 18. The attorney for the Great Northern disclaimed any intention to question the constitutional right of the legislature to delegate the rate-making power, but contended that the law does not afford the railways a proper review in the courts of the findings of the commission, and also that penalties established by the law are excessive.

The report of the New York Up-State Public Service Commission for October shows that 77 per cent. of the steam railway trains operated in New York State were on time during this period, while the average delay of the remaining 23 per cent. of the trains was 26.3 minutes per train. Nearly two-fifths of the aggregate delays for the month were due to trains waiting for trains on other divisions. The chief causes of delay and the percentage which each represented in the aggregate were: Engine failures, 5.6 per cent.; failures of other equipment, 1.7; wrecks, 6; unfavorable conditions of tracks, 2.1; waiting for trains on other divisions, 39.4; waiting for train connections with other railroads, 10.5; meeting and passing trains, 6.8; signals, 1.3; trains ahead, 7.1; waiting for orders, 4; train work at stations 15.2; storms, 2; all other causes, 3.7.

The Minnesota Supreme Court rendered a decision on November 27 in a suit brought by the state against the Minnesota & International for back taxes on gross earnings, in which the items constituting gross earnings were defined. The law imposes a tax of 3 per cent. on gross earnings, and the items constituting gross earnings, the court said, are as follows: "The amount received from lumber companies and other parties in moving, transferring and switching cars at loading works; the amount received for the use of railway companies' equipment, such as steam shovels, hoisting machinery, work trains, cars and engines, including crews; money received from other railway companies for the use of work trains employed in the service of construction work; the amount received by the company for its cars employed in transportation in excess of amount paid out by it for the use of cars of other companies."

At a dinner of the Kansas City Real Estate Exchange in Kansas City, Mo., on the evening of November 24, T. T. Crittenden, Jr., Mayor of Kansas City, and R. J. Ingraham, Attorney for the Public Utilities Commission of that city, spoke in favor of passing an ordinance permitting the building of a new union passenger station and new passenger and freight terminals without a provision requiring the ten roads belonging to the Kansas City Terminal Railroad Company to absorb switching charges perpetually. The question of switching charges has long been a stumbling block in the way of the construction of the proposed new union station. (See *Railroad Age Gazette*, October 23, page 1180.) Mayor Crittenden said that he had received advices from shippers controlling 85 per cent. of the total freight traffic in and out of Kansas City, and urged that the provision in the proposed ordinance to which the railways object shall be eliminated and the ordinance passed. Mr. Ingraham said that there was no use trying further to get a contract with the railways that would give shippers more than existing law would give them. The Real Estate Exchange adopted a resolution favoring the submission of the depot question to a vote of the people of the city.

Automatic Fire Alarm for Bridges.

On the Canadian Pacific, west of Winnipeg, two wooden bridges are now equipped with automatic alarms, designed to stop trains in case the bridge should take fire. Semaphore signals are fixed about 3,500 ft. from the bridge, each way, and to each signal is attached a wire which runs to a pulley on the bridge, whence it is led to another pulley beneath the bridge, where connection is made to a rope running the length of the bridge, and then to a similar wire which is connected to the semaphore on the farther side of the bridge. The semaphore arms are heavily weighted, so that if the rope should part, as in case it should be burned, the signals would fly to the stop position. Track foremen are required to test these wires every day, and roadmasters are instructed to test them each week.

Sale of Consolidated Steamship Lines.

The assets of the Consolidated Steamship Lines Co., consisting of $59,985,600 stocks of six subsidiary companies, amounting to 97 per cent. of the total stock of these companies, have been sold and bid in by the bondholders' protective committee. A new company has been formed called the Atlantic, Gulf & West Indies, and this company will take over the stock of such of the subsidiary companies as it deems profitable. They will issue, it is said, securities aggregating $54,831,800.

Maintenance of Way Association Committee on Electrification.

The American Railway Engineering and Maintenance of Way Association has appointed a committee on Electrification of Steam Roads. The work of the committee will, of course, be confined within the scope of the association's activities, and will not touch on motive power or matters outside of construction and maintenance. Matters already assigned for consideration include transmission line crossings, clearances, insulation and protection, electrolysis, relation of track structures, and maintenance organization. The committee is composed of the following: G. W. Kittredge (N. Y. C.), Chairman; J. M. Austin, Jr. (L. I.), Vice-Chairman; G. A. Harwood (N. Y. C.); F. A. Bagg (F. J. & G.); W. W. Drinker (Erie); H. R. Talcott (B. & O.); C. E. Lindsay (N. Y. C.); E. P. Dawley (N. Y., N. H. & H.); R. D. Coombs (Penna.).

Lumber Cut of the United States in 1907.

The following table shows the number of mills reporting and the quantity and value of lumber, lath and shingles produced in the United States in 1900, 1904, 1905, 1906 and 1907.

Year.	No. mills reporting.	Year.	No. mills reporting.	Year.	No. mills reporting.
1907.....	28,850	1905.....	11,666	1900.....	31,833
1906.....	22,398	1904.....	19,127		

	Lumber.		Lath		Shingles.	
Year.	Quantity, M.ft.B.M.	Value. $	Quantity, thousands.	Value. $	Quantity, thousands.	Value $
1907.	40,256,154	666,641,367	3,663,602	10,342,705	11,824,475	30,111,337
1906.	37,550,736	621,151,388	3,812,807	11,490,570	11,858,260	24,154,555
1905.	30,502,961	445,343,231	3,111,157	7,777,892	15,340,909	28,380,682
1904.	34,135,139	435,708,084	2,647,847	5,435,968	14,547,477	24,009,610
1900.	35,084,166	390,489,873	2,523,998	4,698,909	12,102,017	18,869,705

As in 1906, very much the greatest cut was in the state of Washington, while Louisiana ranks second in both years. After that the order in 1906 and 1907 is not uniform. In 1906 the third place went to Wisconsin and the fourth place to Michigan; in 1907 Texas was third and Mississippi fourth. The lumber production in Washington in 1907 was 3,777,606,000 ft. Louisiana cut not quite three billion feet and Texas about two and one-fourth billion feet.

In total production, yellow pine has an enormous lead over Douglas fir, its nearest competitor, the total being about 13⅕ billion feet, and the total production of Douglas fir about 4¾ billion feet. White pine, oak, hemlock, spruce and western pine range next, in the order named, and for each of the five, a production of over one billion feet was recorded in 1907. The production of white pine was not far behind that of Douglas fir.

The following table shows the cut of yellow pine in 1907 by states:

States.	No. mills reporting.	Quantity, M.ft.,B.M.	Per cent. distribution.	Total value.	Average value per M.ft.
United States	8,384	13,215,185	100.0	$185,319,595	$14.02
Louisiana	408	2,345,912	17.7	$34,402,894	$14.67
Texas	614	2,197,233	16.6	30,349,892	13.81
Mississippi	659	1,692,195	12.8	25,216,356	14.90
Arkansas	634	1,249,133	9.5	18,086,392	14.48
North Carolina	1,427	1,146,388	8.7	14,245,676	12.43
Alabama	821	1,116,784	8.5	15,631,158	14.00
Virginia	956	869,935	6.6	11,239,447	12.92
Florida	285	761,890	5.8	11,415,810	14.98
Georgia	737	755,152	5.7	10,362,153	13.72
South Carolina ...	352	606,976	4.6	8,098,250	13.34
Missouri	227	119,164	0.9	1,396,880	11.72
Oklahoma	79	93,867	0.7	1,206,969	12.86
Maryland	140	81,541	0.6	1,053,719	12.92
Tennessee	146	62,441	0.5	811,609	13.00
All other states* ..	899	116,574	0.9	1,802,390	15.46

*Includes Connecticut, Delaware, Kentucky, Maine, Massachusetts, New Hampshire, New Jersey, Ohio, Pennsylvania, Rhode Island, Vermont and West Virginia.

Government Suit Against Union Pacific.

Testimony in the government's suit to dissolve the Union Pacific Railroad system as a merger in restraint of trade was begun in the New York Custom House, December 1, before Sylvester G. Williams as Special Examiner. The case of the government was in the hands of Frank P. Kellogg and C. A. Severance, the latter appearing in the absence of Mr. Kellogg, who was engaged at the Standard Oil hearing.

The government's bill of complaint petitions that the courts set aside the ownership by the Union Pacific Railroad Company of its subsidiaries, the San Pedro, Los Angeles & Salt Lake Railway Company and the ownership by either the Union Pacific or the Oregon Short Line of stock in the Atchison, Topeka & Santa Fe, the Great Northern and the Northern Pacific railways. These roads are regarded as natural competitors of the Union Pacific.

Attorney-General Bonaparte believes, as do Messrs. Kellogg and Severance, that sufficient evidence that the Union Pacific came within the prohibition of the Sherman act was obtained by the Interstate Commerce Commission at the time of the Chicago & Alton investigation.

Mr. Severance announced that he would read, for the record, the testimony of Alexander Millar, secretary of the Union Pacific and Southern Pacific, and an officer in each of the various subsidiary companies controlling railway and steamship lines. This testimony contained admissions of ownership and control in various subsidiary companies. A majority of the directors in the Union Pacific Company were admitted to be directors in the Southern Pacific.

Meeting of State Railroad Commissions.

A meeting of the Railroad Commissions of Illinois, Wisconsin, Michigan, Ohio and Indiana was held in Chicago on December 2 and 3. This meeting was practically a continuation of the meeting of the same commissions held in Chicago on June 12 and 13 last. (See *Railroad Age Gazette*, June 19, page 199.) It is hoped to give a full report of this meeting in our issue of next week.

American Society of Civil Engineers.

On December 2, a paper by Leonard Metcalf, M. Am. Soc. C. E., entitled "Water-Works Valuation and Fair Rates, in the Light of the Maine Supreme Court Decisions in the Waterville and Brunswick Cases," was presented for discussion.

Canadian Society of Civil Engineers.

At a meeting of the Electrical Section on November 26, a paper entitled "Some Considerations in the Application of Low-Pressure Turbines to Power Generation," illustrated with lantern slides, was read by J. R. Bibbins.

At a meeting of the Mechanical Section on December 3, a paper on "Force or Press Fits for Armature or Fly Wheel Hubs," was read by Kenneth Moodie.

MEETINGS AND CONVENTIONS.

The following list gives names of secretaries, dates of next or regular meetings, and places of meeting.

Air Brake Association.—F. M. Nellis, 53 State street, Boston, Mass.; June, 1909.
American Institute of Electrical Engineers.—R. W. Pope, 33 West 39th street, New York; second Friday in month; New York.
American Railway Association.—W. F. Allen, 24 Park Place, New York; May, 1909; New York.
American Railway Bridge and Building Association.—S. F. Patterson, B. & M. R.R., Concord, N. H.
American Railway Engineering and Maint. of Way Assoc.—E. H. Fritch, Monadnock Bldg., Chicago; March 16-18, 1909; Chicago.
American Railway Master Mechanics' Association.—J. W. Taylor, Old Colony Bldg., Chicago; June 16-18, 1909; Atlantic City.
American Society of Civil Engineers.—C. W. Hunt, 220 W. 57th street, N. Y.; 1st & 3d Wed. in month, ex. July and Aug.; New York.
American Society of Mechanical Engineers.—Calvin W. Rice, 29 West 39th street, New York.
American Street and Interurban Railway Association.—B. V. Swenson, 29 West 39th street, New York.
Association of American Railway Accounting Officers.—C. G. Phillips, 143 Dearborn St., Chic.; last Wed. in April, 1909; Cincinnati.
Association of Railway Claim Agents.—C. L. Young, C. & N.-W. Ry., Chicago, Ill.; May, 1909.
Association of Railway Telegraph Superintendents.—P. W. Drew, Wis. Central Ry., Chicago; June 23-25, 1909; Detroit.
Association of Transportation and Car Accounting Officers.—G. P. Conard, 24 Park Pl., N. Y.; Dec. 8, 9, 1908; Cincinnati.
Canadian Railway Club.—Jas. Powell, Grand Trunk Ry., Montreal, Que.; 1st Tues. in month, except June, July and Aug.; Montreal.
Canadian Society of Civil Engineers.—Clement H. McLeod, Montreal, Que.; January; Montreal.
Central Railway Club.—H. D. Vought, 95 Liberty street, New York; second Friday, in January, March, May, Sept. and Nov.; Buffalo.
Freight Claim Association.—Warren P. Taylor, Rich., Fred. & Pot. R.R., Richmond, Va.; June 16, 1909; Old Point Comfort, Va.
International Master Boiler Makers' Association.—Harry D. Vought, 62 Liberty street, New York; May, 1909; Louisville, Ky.
Iowa Railway Club.—W. B. Harrison, Union Station, Des Moines, Iowa; second Friday in month, except July and Aug.; Des Moines.
Master Car Builders' Association.—J. W. Taylor, Old Colony Building, Chicago; June 21-23, 1909; Atlantic City.
New England Railroad Club.—G. H. Frazier, 10 Oliver street, Boston, Mass.; 2d Tues. in month, ex. June, July, Aug. and Sept.; Boston.
New York Railroad Club.—H. D. Vought, 95 Liberty street, New York; 3rd Friday in month, ex. June, July and Aug.; New York.
North-West Railway Club.—T. W. Flannagan, Soo Line, Minneapolis; 1st Tues. after 2d Mon., ex. June, July, Aug.; St. Paul and Minneapolis.
Railway Club of Pittsburgh.—J. D. Conway, Pittsburgh, Pa.; fourth Friday in month, except June, July and August; Pittsburgh.
Railway Signal Association.—C. C. Rosenberg, 12 North Linden street, Bethlehem, Pa.; Mar. 15, 1909; Chicago.
Roadmasters' and Maintenance of Way Association.—Walter E. Emery, P. & P. U. Ry., Peoria, Ill.; Nov., 1909; Washington.
St. Louis Railway Club.—B. W. Frauenthal, Union Station, St. Louis, Mo.; 2d Friday in month, except June, July and Aug.; St. Louis.
Southern and Southwestern Ry. Club.—A. J. Merrill, Prudential Bldg., Atlanta; 3rd Thurs. Jan., April, Aug. and Nov.; Atlanta.
Traveling Engineers' Association.—W. O. Thompson, N. Y. C. & H. R. R.R., East Buffalo, N. Y.; Sept., 1909; Denver.
Western Railway Club.—J. W. Taylor, Old Colony Building, Chicago; 3d Tuesday each month, except June, July and August; Chicago.
Western Society of Engineers.—J. H. Warder, Monadnock Building, Chicago; first Wednesday, except July and August; Chicago.

Traffic News.

Beginning December 1 the Kansas City division of the Chicago, Rock Island & Pacific, which has been worked by the Wells Fargo Express Co., will be operated by the United States Express Co. The Kansas City division extends from St. Louis to Kansas City.

According to present plans the committee of shippers appointed by President Upham, of the Illinois Manufacturers' Association, to confer with the railways on the proposed freight rate advance and the railway committee, will meet on December 8 in Chicago.

The eastern lines have announced an advance in proportional class rates, lake and rail, from Baltimore and Philadelphia to points west of the west bank of the Mississippi river. The increase on classes 1, 2, 3 and 5 is 2 cents per 100 lbs. Fourth class is advanced 1 cent.

Judge Smith McPherson has postponed to December 14 further hearing in the case involving the constitutionality of the Missouri freight and passenger rate laws. It was expected to resume the hearing on November 30, but the court found it necessary to make a further postponement.

The Pacific Car Service Bureau reports a total car movement for October, 1908, of 121,500 cars, as against 116,827 cars for October, 1907. Of the 1908 total, 111,264 cars were commercial and 10,236 cars were company. Detentions of commercial cars overtime amounted to 7,326 as against 8,242 in October, 1907.

In the Pittsburgh demurrage territory the total car movement in October was the largest thus far this year, with 217,287 cars, as against 296,727 cars in October, 1907. The total car movement in this district for the first 10 months of the year was 1,594,672 cars, as against 2,559,022 cars for the same 10 months of 1907.

The Postoffice department has ruled that the railways shall hereafter be paid monthly for hauling the mails. Heretofore they have been paid quarterly. The change has been brought about mainly through the efforts of Guy Adams, Supervisor of Mails on the Rock Island, and probably means $200,000 a year to the railways of the country.

The Trunk Line Association has authorized merchants' rates to New York for the spring of the 1909 season. The special fare and one-half for the round trip will be in effect under the customary certificate plan on January 16 to 19 inclusive; February 20 to 23 inclusive; March 6 to 9 inclusive, and March 20 to 23 inclusive, with the usual 15-day return limit.

The Chicago Junction Co. and the Union Stock Yards Co. have challenged the right of the Interstate Commerce Commission to inquire into their affairs on the ground that their tracks and business are within the state of Illinois. The Commission considers that terminal roads are under their jurisdiction, since terminal charges are a part of a through rate.

Trans-Atlantic steamship lines from New York and rail carriers to that port are suffering serious diminution of traffic in cattle because of the outbreak of the foot and mouth disease and of the orders of the British and American governments to prevent its spread. On this account the Georgic, of the White Star line, sailed December 2 with no cattle or sheep on board, although the steamer generally carries from 800 to 1,000 head of cattle and some 1,500 sheep on the outward voyage.

On November 28 the Baker-Whiteley Coal Co., of Baltimore, Md., was fined $3,700 in the United States district court for violation of the Interstate Commerce law on a plea of guilty to accepting rebates from the Pennsylvania Railroad on shipments of coal. According to the evidence submitted by the district-attorney the Baker-Whiteley Company accepted rebates of 12 cents a ton on coal last March and April, this rebate having been allowed on coal for shipments on vessels for points outside the Chesapeake capes, or burned under the boilers of steam vessels destined to points outside the capes.

The Railroad Commission of Mississippi has cited Seeley Dunn, Manager of the Louisiana Car Service Association, and W. A. Moody, Manager of the Alabama Car Service Association, to appear before it on December 8 to show cause why they should not make restitution for what are alleged to be overcharges for a violation of the state demurrage law. Complaints have been made by merchants who have their places of business distant several miles from their stations, and they claim that they are entitled to five or seven days under the demurrage laws of the state, whereas they have been given but 48 hours.

The Southern Railway has sent out a circular advising agents and connections that it has decided not to put the new uniform bill of lading into use at points on the Southern Railway until January 1. It is the company's intention to use the bill of lading approved by the Interstate Commerce Commission at all points on the Southern Railway from and after January 1. An effort is now being made by interests representing the water and rail routes to bring about some slight modification necessary to its application to water and rail traffic, and some other slight modification to meet certain local conditions, but none of these proposed changes materially affect the terms approved by the commission.

The tariffs that the Canadian Pacific has filed with the Interstate Commerce Commission on traffic to the Orient show that this road, after December 4, will in many cases apply its domestic rates to the Pacific coast on goods moving to the Far East. For example, its rate on agricultural implements to the Pacific coast is $1.35 per 100 lbs., and it will be the same to the Orient. The railway's proportional of the rate on agricultural implements when shipped to the Orient will be 81 cents. The through and domestic rate on beer is $1.10, of which the road accepts 66 cents as its proportional on export business. The domestic and through rate on packing house products is $1.65, and the road gets 99 cents as its proportional on export business. These rates are illustrative. All roads running from Chicago to St. Paul have concurred in the Canadian Pacific's tariffs excepting the Chicago, Burlington & Quincy and the Illinois Central.

James E. Smith, President of the St. Louis Business Men's League, made an address before the Toledo Transportation Club on November 19, in which he argued against an advance in freight rates. He said he did not overlook the fact that tariffs to-day are much below what they were 20 to 25 years ago. But the reductions which have been made are merely a part of the economies that have been introduced into the business of the country, and he did not think they would furnish an adequate argument to justify increases now. Shippers have adjusted their business to lower schedules. He thought it not unreasonable for shippers to ask, with the favorable turn in business, that the railroads should refrain from increasing rates at least for a few months until they and shippers can see if any advances be necessary. "We must get away from a tendency in certain parts of the country to indulge in anti-railroad agitation during every political campaign and in anti-railroad legislation at every session of the legislature. The more publicity the railroad managers give us the easier it will be to put an end to the railroad rate issue in local politics."

INTERSTATE COMMERCE COMMISSION.

The Interstate Commerce Commission has postponed until July 1, 1909, the time when its order that railways desist from paying allowances to the proprietors of elevators for handling grain shall become effective.

Where a through rate is higher than the combination of locals, the commission again expresses the opinion that the higher through rate is unjust, and holds that the through rate should not be in excess of the combination of locals.

A stock-cattle rate not to exceed 75 per cent. of the beef-cattle rate is held to be proper, and where such an adjustment of rates on the Pierre, Rapid City & Northwestern was not in effect, shippers who were charged the full beef-cattle rate on stock-cattle are entitled to damages amounting to 25 per cent. of the total rate charged them.

Through an error, the rate on bar iron from Fort Wayne, Ind., to Joliet, Ill., was fixed at 9 cents per 100 lbs., the

through rate to Peoria, Joliet being the intermediate point. Later the rate was reduced to 8 cents, corresponding to the rate from Fort Wayne to Chicago. Damages were allowed to shippers who paid the higher rate while it was in effect, although this higher rate was the rate published in the railroad company's schedule of rates at that time.

Reconsigning Charges and Demurrage.

Beckman Lumber Co. v. St. Louis Southwestern. Opinion by Commissioner Clements.

Four carloads of lumber were shipped on various dates in July, 1907, from Thornton, Ark., to East St. Louis, Ill., and subsequently reconsigned to Granite City, Ill. A charge of $5 per car was made for reconsigning, in conformity with the published tariffs of the defendant. A carload of lumber was shipped August 22, 1907, from Atlanta, La., to East St. Louis, Ill., and reconsigned upon arrival at Bixby to Granite City, a charge of $2 being made. The reconsigning charge of $5 is reasonable since no evidence is produced to show that Granite City is within the free switching limits of East St. Louis, but the circumstances were different in the case of the shipment of lumber from Atlanta, La., since the charge of $2 is properly a demurage charge, and the delay of moving the car was caused by the fact that the complainant was not on the credit list of the railway company, and the car was therefore not moved until charges were prepaid. The amount of the charge in such a case is dependent upon the promptness of the carrier in notifying consignee that freight money must be paid in order to release the shipment, and of the consignee in paying the money. Herein lies the possibility of undue preference in favor of the consignee who is fortunate enough to be on the credit list of the carrier, and unjust discrimination against the consignee who is not. The charge of $2 demurrage was improper and should be refunded.

STATE COMMISSIONS.

The Railroad Commission of Louisiana has ordered all railways in the state to file with it at once copies of their rules governing the operation of trains and to file immediately all future amendments of these rules.

The Indiana Railroad Commission has ruled that it has no authority to make an order permitting a consignee to hold cars, without paying demurrage, longer than the 48 hours free time allowed by statute. The Indianapolis Light & Heat Company and the Indianapolis Water Company asked the Commission for an order requiring railways to permit these companies to hold cars three days longer than the statutory free time and to charge them only 25 cents a day demurrage.

More Power Wanted by the Texas Commission.

The Railroad Commission of Texas in its annual report will ask the legislature for legislation increasing its powers in several respects. The Commission desires authority to require county and district attorneys to bring suits against the railways. This would relieve the Attorney-General's office of a good deal of work. The legislature is also asked for a law to authorize the Commission to require express companies to call for and deliver packages beyond the limits at present fixed by the companies, and for legislation to authorize the Commission to require the building of union depots in towns where this is considered desirable, to specify the kind of station to be built and to apportion the cost among the interested roads. In speaking of its bookkeeping orders the Commission says it has had much difficulty in getting at what a reasonable freight rate is because it has been unable to secure any information showing what the cost of moving any particular kind of traffic is, and it expresses doubt whether it will ever have definite knowledge as to the reasonableness of rates until it can learn definitely something about the costs of handling particular kinds of traffic. It says that one of the purposes of its bookkeeping orders was to enable it to ascertain these costs. It asks for express authority to require rates to be based upon the shortest mileage between any two points. It also asks authority to require railways to construct depots at state lines or at the terminus of any railway where conditions may justify such an order, the purpose of the proposed legislation regarding the construction of depots at state lines being to enable the Commission to control interstate rates. The Commission also asks for authority to enforce orders which it issues requiring improvements in the physical condition of railways, and ask that its power to require railways to build side tracks and spur tracks to private industries be more clearly defined.

Harbor Allowances by New York Trunk Lines.

All the New York trunk lines have filed with the Interstate Commerce Commission a joint answer to the charge filed by Philadelphia interests that they were violating the Interstate Commerce law by so-called accessorial allowances for harbor transportation. The brief contends that the harbor transfer allowances do not constitute an interstate issue; that the whole question is whether payment of an allowance to or for the benefit of a shipper in excess of actual cost is, per se, illegal. "If so," the brief proceeds, "it seems there cannot be but one answer to such question."

The following allowances, among others, appear in the tariffs of all of the roads:

1. An allowance of 12 cents a ton for unloading freight from barges or lighters where men are not readily available.
2. An allowance of 3 cents per hundred on various commodities, delivery of which is taken on the Jersey shore, to cover cost of cartage and ferriage.
3. Various allowances for lightering heavy articles which the carrier cannot conveniently handle.
4. Eight and 4 cents a hundred, depending on class, to cover cartage on import freight.
5. Three cents a hundred to cover transfer of tobacco from steamship to railway pier.

"Not one of the foregoing provides for payment of the actual cost to the shipper. In almost every case the payment is either more or less than cost, depending on the location of the shipper in New York, the amount of his business and many other circumstances.

"We have no doubt that throughout the United States there are hundreds of allowances of the same nature, all based on average cost. Any rule of the Commission declaring an allowance in excess of actual cost to be illegal would revolutionize these long-standing practices, and as it would be impossible to conform to such rule, in most cases, would deprive shippers of privileges of long standing and of great value.

"Suppose the Commission was considering instead of the legality of the transfer allowance the legality of lighterage allowances. Carriers, largely, lighter freight themselves, but lighterage allowances are made or participated in to an extent by most of the lines, particularly by the coastwise lines, and have been notoriously paid for years on the basis of a uniform amount regardless of the particular cost to the shipper. There is absolutely no difference between the two as a matter of legal principle. Transportation rates, rules and practices cannot be framed upon an exact mathematical basis. This has been recognized in a long line of cases cited in our filed argument."

"Moreover, we maintain broadly the proposition that we, as the steamship lines, may, for sufficient reasons, legally assume a store door reception of carloads of sugar; that as we cannot as a practical matter efficiently perform that service ourselves, certainly not at a less cost than two cents a hundred pounds, and as that sum fairly represents the average cost to the average shipper, we may lawfully make a uniform allowance of that amount to all carload shippers."

In conclusion the brief shows as follows:

"These very allowances are now being paid at New Orleans without complaint of any one, and we know what the effect at that port will be of a ruling declaring the payments to be illegal. When we take into consideration the interests of the coastwise lines the effect of any ruling upon the performance of accessorial services by carriers and upon the hundreds of allowances now being made to the shippers of this country, we insist that unless the commission must conclude that the allowances here under consideration clearly and certainly violate some section of the act, it should make no adverse ruling with respect to their legality."

REVENUES AND EXPENSES OF RAILWAYS.

MONTH OF SEPTEMBER, 1908.

See also issues of November 6, 13, 20 and 27.

Name of road.	Mileage operated at end of period.	Operating revenues			Operating expenses						Net operating revenues (or deficit).	Outside operations. net.	Taxes.	Operating income (or loss).	Increase (or dec.) comp. with last year.
					Maintenance										
		Freight.	Passenger.	Total, inc. misc.	Way and structures.	Of equipment.	Traffic.	Transportation.	General.	Total.					
Alabama & Vicksburg	143	$72,758	$36,152	$117,369	$17,143	$31,414	$3,392	$42,323	$4,910	$99,182	$18,187	$565*	$3,600	$14,022	†$12,006
Atlantic City	167	56,457	99,361	164,205	20,729	12,047	1,534	62,882	676	97,868	66,337	14,256*	7,000	45,081	9,213
Baltimore, Chesapeake & Atlantic	88	10,516	8,171	20,811	2,926	1,618	280	7,936	628	13,388	7,423	22,778	1,363	28,838	433
Cincinnati & Muskingum Valley	148	56,306	16,799	77,289	15,679	11,008	1,761	25,353	1,097	54,898	22,391	.....	3,496	18,895	†1,672
Cincinnati Northern	248	78,413	20,512	104,517	23,128	10,568	2,655	32,652	2,364	71,367	33,150	.....	4,000	29,150	9,258
Cleveland, Akron & Columbus	210	127,720	48,397	189,220	16,407	35,935	2,749	53,284	2,827	111,202	78,018	.....	6,500	71,518	†4,660
Cleveland, Lorain & Wheeling	194	305,369	21,997	353,201	28,107	65,518	5,885	120,264	5,764	225,538	127,663	.....	9,406	118,257	†67,609
Cleveland Terminal & Valley	93	74,057	16,724	97,892	11,769	9,620	1,398	35,111	1,436	59,334	38,558	.....	3,358	35,200	†2,587
Coal & Coke	191	47,965	11,411	61,172	10,532	14,803	1,086	15,006	2,342	43,769	17,403	4,788	3,500	18,691	7,296
Cumberland Valley	162	160,440	50,705	221,373	21,698	22,485	3,621	64,136	6,821	118,761	102,613	105	3,713	99,005	†12,391
Fort Worth & Rio Grande	196	46,258	24,606	76,388	14,548	9,768	2,595	34,280	4,822	66,013	10,375	.....	501	9,874	6,037
Houston, East & West Texas	191	69,458	21,747	97,685	19,533	7,532	1,307	25,659	3,149	57,180	40,505	.....	1,480	39,025	8,007
Indianapolis Southern	179	52,573	24,234	81,144	16,919	8,577	1,002	30,433	1,405	58,336	22,808	.....	2,391	20,417	13,929
Lehigh & New England	167	68,627	2,236	72,163	17,950	8,350	689	18,265	2,104	47,358	24,805	.....	850	23,955	1,564
Louisiana & Arkansas	226	82,462	12,881	98,654	23,291	16,995	1,668	27,985	4,088	74,027	24,627	.....	1,350	23,277	†15,702
Louisiana Western	198	109,854	40,041	157,118	15,892	17,386	4,346	45,749	6,633	90,006	67,112	740	4,925	62,927	8,132
New Orleans & Northeastern	196	180,338	46,077	241,313	25,191	53,637	7,811	74,888	9,901	171,428	69,885	133*	6,750	63,002	10,834
New York, Philadelphia & Norfolk	112	181,812	34,539	232,472	19,984	41,473	3,096	81,305	13,549	159,407	73,065	.....	6,215	66,850	†28,601
New York, Susquehanna & Western	151	122,470	54,577	198,174	26,035	21,548	1,244	72,686	4,142	125,655	72,519	4,510*	4,738	63,271	13,166
Pecos & Northern Texas	153	68,960	23,707	95,739	12,306	8,630	806	23,547	2,925	48,214	47,225	.....	2,011	45,514	45,041
Pittsburg & Lake Erie	191	950,082	108,896	1,087,515	123,686	108,315	10,674	239,383	19,802	501,860	585,655	178*	17,500	567,977	†225,624
Richmond, Fredericksburg & Potomac	83	63,399	47,267	125,413	15,484	22,379	2,019	49,243	4,525	93,650	31,763	.....	200	31,563	†10,559
Rio Grande Southern	180	37,364	11,065	52,032	10,613	3,176	119	14,329	2,903	31,140	20,892	.....	2,500	18,392	7,178
St. Louis Merchants Br. Term. Co	9	.....	3,510	115,368	18,831	4,838	235	42,873	3,207	69,984	45,384	.....	4,300	41,084	†16,225
St. Louis, San Francisco & Texas	126	57,384	9,466	68,944	13,020	10,588	1,916	36,294	3,886	65,704	3,240	.....	1,116	2,124	†658
Southern Indiana	237	80,406	12,850	95,717	13,405	15,164	1,455	22,691	5,630	58,345	37,372	.....	6,929	30,443	†29,864
Southern Kansas Ry. of Texas	125	68,790	22,676	94,736	15,666	15,957	925	26,694	2,896	62,138	32,598	.....	2,236	30,362	81,052
Tonopah & Goldfield	109	63,961	18,411	87,912	7,177	9,740	2,144	43,990	6,313	69,364	18,548	72	4,591	14,028	†33,691
Ulster & Delaware	129	49,946	37,235	91,389	14,811	9,761	995	38,784	2,278	66,629	24,760	165	3,000	21,925	11,148
Union R.R. of Baltimore	9	69,306	18,190	89,107	3,804	.....	239	4,742	1,394	10,179	78,928	.....	2,882	76,046	†28,308
Vicksburg, Shreveport & Pacific	171	64,223	38,549	110,394	15,892	28,277	2,868	32,778	4,373	84,188	26,206	923*	5,800	19,483	†1,422
Wabash-Pittsburgh Terminal	63	74,439	6,032	82,408	10,996	6,755	2,094	23,696	6,496	50,037	32,371	.....	6,258	26,113	†54,695
Washington Southern	36	25,622	26,916	66,181	10,749	5,833	899	26,682	2,287	46,450	19,731	.....	2,345	17,386	8,533
Western Ry. of Alabama	133	49,463	32,857	89,909	16,313	13,127	4,083	24,150	4,274	61,947	27,962	144*	4,410	23,407	3,706
THREE MONTHS, ENDING SEPTEMBER 30, 1908.															
Alabama & Vicksburg	143	$203,714	$114,680	$343,306	$63,156	$72,988	$9,603	$124,133	$14,602	$284,482	$58,824	$1,495*	$10,800	$46,529	†$24,654
Atlantic City	167	172,348	456,375	654,662	61,706	35,442	5,335	269,243	2,068	373,794	280,868	15,939*	21,000	243,929	†24,931
Baltimore, Chesapeake & Atlantic	88	32,105	63,194	101,156	11,895	4,744	2,510	29,815	1,988	50,952	50,204	63,995	4,090	109,119	3,092
Cincinnati & Muskingum Valley	148	150,269	52,087	215,642	36,529	27,382	5,320	72,393	3,602	145,226	70,416	.....	10,596	59,820	†10,140
Cincinnati Northern	248	208,660	74,140	297,015	63,264	30,120	8,264	92,966	6,701	201,315	95,700	.....	12,000	83,700	44,448
Cleveland, Akron & Columbus	210	333,005	134,063	504,454	67,321	87,759	7,356	151,452	9,368	323,256	181,198	.....	19,000	162,198	†22,344
Cleveland, Lorain & Wheeling	194	1,080,549	68,209	1,233,526	110,057	203,447	18,380	374,142	16,944	722,970	510,556	.....	28,219	482,337	†113,635
Cleveland Terminal & Valley	93	206,602	50,549	273,774	36,784	26,047	4,499	105,249	4,409	176,988	96,786	.....	10,076	86,710	7,428
Coal & Coke	191	127,408	38,562	171,282	31,514	41,077	2,264	44,818	6,497	126,170	45,112	14,190	10,500	48,802	20,741
Cumberland Valley	162	450,746	163,435	642,905	69,202	55,366	11,309	186,572	16,434	338,883	304,022	2,139	11,139	295,022	†36,276
Fort Worth & Rio Grande	196	113,563	76,985	206,199	45,835	24,250	7,289	86,332	12,692	176,398	29,801	.....	4,772	25,029	9,192
Houston, East & West Texas	191	199,233	69,610	286,240	47,219	22,471	3,950	87,944	9,487	171,071	115,169	.....	7,960	107,209	17,353
Indianapolis Southern	179	158,446	71,001	240,842	63,439	22,112	3,497	90,891	4,276	184,215	56,627	.....	7,175	49,452	31,312
Lehigh & New England	167	198,747	6,026	209,965	46,254	23,710	2,294	53,348	6,951	132,557	77,408	.....	2,550	74,858	†16,260
Louisiana & Arkansas	226	224,786	40,264	282,722	57,531	51,662	4,646	86,091	13,637	213,567	69,155	.....	4,100	65,055	†67,992
Louisiana Western	198	287,069	125,823	434,746	43,791	61,167	14,263	130,396	18,941	268,558	166,188	1,578	14,775	152,991	†967
New Orleans & Northeastern	196	480,252	135,698	656,571	66,432	130,395	22,300	223,072	28,324	470,523	186,048	443*	20,250	165,355	†32,416
New York, Philadelphia & Norfolk	112	555,477	114,083	720,111	56,542	117,602	8,563	250,199	35,539	468,445	251,666	.....	18,645	233,021	†113,544
New York, Susquehanna & Western	151	366,893	168,926	601,533	83,288	62,151	3,924	211,715	11,533	372,611	228,922	11,571*	14,214	203,137	33,052
Pecos & Northern Texas	153	180,006	66,931	257,534	27,972	20,233	2,177	65,388	8,488	124,258	133,276	.....	6,034	127,242	125,237
Pittsburg & Lake Erie	191	2,769,360	349,917	3,213,351	378,300	267,685	37,129	691,431	59,148	1,433,693	1,779,658	908*	52,500	1,726,250	†718,431
Richmond, Fredericksburg & Potomac	83	236,515	134,014	418,324	53,191	68,603	5,703	159,382	12,597	299,476	118,848	.....	600	118,248	†42,777
Rio Grande Southern	180	109,671	34,401	154,785	32,319	7,832	481	42,200	6,674	89,506	65,279	.....	7,500	57,779	7,956
St. Louis Merchants Br. Term. Co	9	.....	9,403	317,190	53,252	13,616	649	124,709	9,888	202,114	115,076	.....	14,333	100,742	†41,536
St. Louis, San Francisco & Texas	126	156,548	25,341	190,238	44,811	26,334	5,519	91,134	10,698	178,496	11,742	.....	3,508	8,234	†237
Southern Indiana	237	256,450	47,184	311,580	56,021	56,874	5,622	89,061	22,170	229,748	81,832	.....	20,785	61,047	†99,437
Southern Kansas Ry. of Texas	125	162,956	58,393	230,870	42,634	37,309	2,305	75,500	8,048	165,796	65,074	.....	6,707	58,367	177,953
Tonopah & Goldfield	109	191,212	54,915	262,132	25,670	28,996	5,649	133,424	18,423	212,162	49,970	185	13,774	36,381	†148,647
Ulster & Delaware	129	152,339	179,001	342,053	46,595	26,880	3,724	121,521	6,750	205,470	136,583	284	9,000	127,867	19,097
Union R.R. of Baltimore	9	217,874	52,116	275,242	13,030	.....	744	14,189	4,179	32,142	243,100	.....	8,645	234,455	†85,248
Vicksburg, Shreveport & Pacific	171	176,148	119,439	320,422	47,892	67,094	9,705	98,491	12,297	235,479	84,943	1,659*	17,400	65,884	4,385
Wabash-Pittsburgh Terminal	63	236,413	21,842	264,777	27,961	24,118	5,335	71,626	18,207	147,247	117,530	.....	18,755	98,775	†169,385
Washington Southern	36	93,655	71,147	210,775	30,912	18,719	2,555	83,333	6,461	141,980	68,795	147	7,035	61,907	8,104
Western Ry. of Alabama	133	121,512	106,635	250,094	47,790	41,335	11,729	74,167	12,612	187,633	62,461	587*	13,231	48,643	16,462

*Loss. †Decrease.

The Virginia 2-Cent Fare Case.

On November 30 the Supreme Court of the United States reversed the decision of the United Circuit Court for the eastern district of Virginia, which held unconstitutional the order of the state railway commission fixing a 2-cent passenger rate on state business. The rate was named by the commission in accordance with authority bestowed by the Virginia constitution, but the order had no sooner been announced than the railways of the state began action in the United States Circuit Court, praying for an injunction against the enforcement of the decree. This application was based on the ground that the present rates of compensation are reasonable and not discriminatory, either as between individuals or localities.

It was contended on behalf of the roads that the effect of the rate proposed would be to reduce charges below a reasonable and just compensation; that the order was confiscatory and would have the effect of taking their property without due process of law. The state authorities attacked the jurisdiction of the court, claiming that the commission itself was a court as provided by the state constitution, and that its decrees could not be interfered with by a federal tribune.

After hearing the arguments in the case, Judge Pritchard, on December 26, 1907, issued a final decree granting the power of railways and enjoining the enforcement of the commission's order of reduction. He held that the commission's duties were administrative and not judicial. This decision was overruled by to-day's action in the Supreme Court, Justice Brewer alone dissenting. Justice Holmes in his opinion said that the proceeding of the commission was legislative and not judicial in character, and that the court's decision of reversal was based on the failure of the railways to exhaust their rights in the state courts. In effect, the court directs that the railways take their case to the state court of last resort, and that in order to prevent injustices through the possible application of the statute of limitations, the case be retained on the docket of the United States Circuit Court by which it was originally decided favorably to the roads. That is to say, if it be too late to take an appeal to the Court of Appeals of Virginia, according to the statute of limitations, the order of the United States Circuit Court enjoining the Virginia commission must be affirmed. If the Court of Appeals, however, entertains the appeal, then the railways will have the right to proceed in the Circuit Court of the United States to question the validity of any order of the Virginia Court of Appeals as contrary to the constitution of the United States, and they need not come from the Virginia Court of Appeals by writ of error to the Supreme Court of the United States.

The most vital point in this decision is that the action of the corporation commission in fixing the rate of fare has been declared by the Supreme Court to be legislative and not judicial, so that it could not escape review by the federal courts. On the question of the fundamental divisions of authority between state and national government, which created so much difficulty a year ago, the court speaks plainly. In the language of Justice Holmes, a state cannot tie up a citizen of another state having property within its territory invaded by unusual acts of its own officers to suits for redress in its own courts.

Hearing in Southwestern Rate Case.

In the hearing before Commissioners Harlan and Lane at San Antonio, Tex., in the proceeding begun by the Railroad Commission of Texas to prevent the railways from collecting higher class rates to the Southwest (see also page 1456), R. H. Johnson, Assistant General Freight Agent of the Chicago, Rock Island & Pacific, gave testimony tending to show that the new adjustment of rates would benefit the jobbers of Texas, this being due to the fact that less than carload rates were raised more than carload. He defended the new rates, on the basis of mileage, as well as on other bases, trying to show that they are fair and even favorable to Texas merchants and jobbers. He said that rates from St. Louis to Texas, for example, were lower, proportionally, than from Chicago to Nebraska. He defended the Texas common points rate system as giving lower interstate rates than would otherwise be practicable. Owing to reductions in commodity rates average rates to Texas are lower than five years ago. Mr. Johnson showed that the average reduction on 136 staple articles since 1891 was 9.4 per cent., and that since 1903 there had been 6,602 reductions and 2,252 advances.

H. H. Haines, secretary of the Galveston Chamber of Commerce, charged that an agreement existed between the railways and steamship lines, whereby rates are so adjusted as to give the New York-Galveston steamship lines a practical monopoly of business to Texas seaboard points, while the railways are given a similar control of business to inland points.

Mr. Johnson presented a table to show that the advances in rates would produce only a trifling effect upon prices, but yet would add substantially to railway earnings. Explaining the fact that the large trunk lines give smaller divisions on through lines to their controlled lines in Texas than to other roads, Mr. Johnson said competition forced this.

H. G. Askew, statistician of the Texas roads, introduced statistics showing that the net deficit of the roads in the state from 1888 to 1907 was $15,597,438, and that in the year ended June 30, 1908, the net deficit was over $9,000,000. Previous testimony had shown that these roads had been heavy borrowers from the lines controlling them. He showed that in 1906 the railways in the group, of which Texas is part, paid less dividends than the roads in any other of the ten groups into which the roads of the country are divided by the Interstate Commerce Commission. Only six Texas roads paid dividends that year. On the basis of the State Tax Board's valuation 36 roads having 95 per cent. of the mileage in Texas and 98 per cent. of the business paid 5.44 per cent. in 1906, 5.97 per cent. in 1907 and 3.27 per cent. in 1908. The railways contend that they ought to be allowed to earn at least 8 per cent., the legal rate of interest in Texas.

Further hearings in this proceeding will be held at some time not yet fixed.

Railroad Officers.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

James A. Minor has been appointed Assistant General Land and Tax Agent of the Erie, with office at New York, succeeding E. M. Hunt, resigned.

Operating Officers.

J. W. Ryan, General Superintendent of the Salt Lake & Ogden, has resigned.

H. J. Titus has been appointed Superintendent of Dining Cars of the Northern Pacific, with office at St. Paul, Minn.

J. A. Macgregor has been appointed Superintendent of the Fourth district of the Canadian Pacific, succeeding Allan Purvis, transferred.

F. W. Rothas has been appointed Chief Despatcher of the Montana division of the Oregon Short Line, with office at Pocatello, Idaho, succeeding F. M. Clarke, resigned.

George S. Cantilo, Superintendent of Car Service of the Canadian Pacific, has been appointed also General Superintendent of Car Service, with office at Montreal, Que.

F. S. Guthrie, Assistant Superintendent of the Houston division of the Galveston, Harrisburg & San Antonio, has been appointed Terminal Trainmaster at San Antonio, Tex.

D. W. Davis has been appointed Superintendent of Transportation in charge of Car Records and similar transportation matters of the Mobile, Jackson & Kansas City, with office at Mobile, Ala.

J. B. Wallace has been appointed Superintendent of the Coahuila & Pacific and Saltillo divisions of the Mexican Central, with office at Saltillo, Mex., succeeding C. T. Norton, transferred.

P. L. McManus, Assistant to the General Manager of the Southern Railway, has resigned and his office has been abolished. Departments heretofore reporting to the Assistant

to the General Manager now report to C. H. Ackert, Vice-President and General Manager.

J. D. Brennan, Trainmaster of the Gulf division of the International & Great Northern, at Palestine, Tex., has been appointed Assistant Superintendent of the Houston division of the Galveston, Harrisburg & San Antonio, succeeding F. S. Guthrie, assigned to other duties.

S. G. Strickland, General Superintendent of the Chicago, St. Paul, Minneapolis & Omaha, with office at St. Paul, Mo., has been appointed Assistant General Superintendent of the Chicago & North-Western lines east of the Missouri river, with office at Chicago. F. R. Pechin, Superintendent of the Wisconsin division of the Chicago & North-Western, succeeds Mr. Strickland. G. W. Dailey, Superintendent of Telegraph of the North-Western, succeeds Mr. Pechin. William Bennett, Assistant Division Superintendent at Antigo, Wis., succeeds Mr. Dailey. W. F. Armstrong, Assistant Division Superintendent at Escanaba, Mich., succeeds Mr. Bennett. C. E. Helmer, Trainmaster at Escanaba, Mich., succeeds Mr. Armstrong, and W. J. Keating succeeds Mr. Helmer.

Albert W. Newton, whose appointment as Superintendent of the Creston division of the Chicago, Burlington & Quincy has been announced in these columns, was born in 1867 at Jerseyville, Ill. He received his education in the public schools and from private instruction. From 1887 to 1900 he was in general engineering work, principally hydraulic engineering. He began railroad work in September, 1900, as Assistant Engineer of the Chicago & Alton. In 1903 he was appointed Engineer of Construction in charge of building a branch of the Chicago, Burlington & Quincy from Mexico, Mo., to Cedar City. In September, 1904, he was made Assistant Engineer of the Illinois lines, and in November of the same year was given charge of the Missouri district. In January, 1907, he was appointed General Inspector of Permanent Way and Structures on the staff of the Second Vice-President. His present appointment was effective November 1.

Traffic Officers.

J. S. Houston has been appointed Agent for the International & Great Northern at St. Louis, Mo.

C. B. Van Skite, Chief Clerk in the Claim Department of the Gulf, Colorado & Santa Fe, has been appointed Live Stock Agent at Ft. Worth, Tex.

F. M. Lassiter, Assistant Freight Agent of the Southern Pacific at Houston, Tex., has been appointed General Agent freight department at El Paso, Tex.

J. L. Bennett, City Solicitor of the Freight Department of the Chicago, Rock Island & Pacific at St. Paul, Minn., has been appointed Traveling Freight Agent for the Northwest territory. R. T. Gourley succeeds Mr. Bennett.

F. M. Thompson, Traveling Passenger Agent of the Atlanta & West Point at Atlanta, Ga., has been appointed District Passenger Agent at Atlanta, a new office. Clarence Wickersham, city passenger agent at Atlanta, succeeds Mr. Thompson.

L. L. McCleskey, Division Freight Agent of the Southern Railway at Atlanta, Ga., has been appointed Assistant to the General Freight Agent, with office at Atlanta, Ga. Howell Peeples succeeds Mr. McCleskey, and will have charge of the Atlanta and Columbus traffic divisions.

Engineering and Rolling Stock Officers.

J. B. Cozart, Master Mechanic of the Mexican Railway at Apizaco, Puebla, Mex., has resigned to go to the Pan-American.

H. Carrick has been appointed Assistant Division Master Mechanic of the Oregon Short Line, with office at Pocatello, Idaho.

W. S. Cotterman, Superintendent of Telegraph of the Detroit, Toledo & Ironton at Toledo, Ohio, has resigned, and his duties are assumed by the General Superintendent.

Harry J. Hair has been appointed Foreman of the Baltimore & Ohio Southwestern at Seymour, Ind. He graduated in mechanical engineering from Purdue University with the class of 1906 and has been connected with this road since that time.

Thomas Sinnott, Roadmaster of the Glenns Ferry district, Idaho division, of the Oregon Short Line, has been appointed Roadmaster of the Kemmerer district, with headquarters at Montpelier, Idaho, succeeding P. A. Pheney, who has been transferred to the Glenns Ferry district, succeeding Mr. Sinnott.

Carl Frederic Smith, whose appointment as Master Mechanic of the Tombigbee Valley has been announced in these columns, was born September 19, 1873, at Whistler, Ala. He received his education at the public schools and began railway work with the Mobile & Ohio on September 23, 1889. In January, 1901, he was appointed Assistant to the Master Mechanic of the Mexican Central at Guadalajara, Mex. In 1902 he went to the Louisville & Nashville as Airbrake Foreman, with office at Mobile, Ala. During 1903 he was instructor for the International Correspondence Schools, Scranton, Pa. The next year he re-entered railroad service as Airbrake Foreman of the Illinois Central at Louisville, Ky. In 1905 he was made Inspector of the Airbrake Department of the Chicago & Eastern Illinois at Danville, Ill. In 1906, he was appointed Special Railway Representative of the Cataract Refining & Manufacturing Co. of Buffalo, N. Y., which position he held until his recent appointment. Mr. Smith is a member of the Airbrake Association and of the Traveling Engineers' Association.

J. D. Harris, whose appointment as General Superintendent of Motive Power of the Baltimore & Ohio we have announced, began railway work as a machinist apprentice on the Pennsylvania Lines West in October, 1889. He later became a locomotive fireman, and in March, 1895, was made Assistant Foreman and later Foreman of the machine shops of the Pittsburgh, Fort Wayne & Chicago. In February, 1897, he was made Assistant Road Foreman of Engines, and five months later became Assistant Engineer of Motive Power of the Northwest System of the Pennsylvania Lines West. In January, 1898, he was made Master Mechanic of the Eastern and Toledo divisions, with headquarters at Crestline, Ohio, and the next year was made Master Mechanic of the Cleveland & Pittsburgh, now part of the Pennsylvania Lines West. In 1901 he was made Assistant to the General Superintendent of Motive Power of the Baltimore & Ohio, which position he held for two years, and then became Assistant Chief Engineer and Works Manager of the Westinghouse Co., holding this position until his recent appointment.

J. D. Harris.

Purchasing Officers.

Daniel Royce, formerly Assistant Editor-in-Chief of the *Railway Age*, has been appointed Assistant to W. V. S. Thorne, Director of Purchases of the Harriman Lines, with office in New York City.

W. H. Thorn has been appointed General Storekeeper of the Chicago, St. Paul, Minneapolis & Omaha, with headquarters at the St. Paul, Minn., Shops, succeeding G. A. Gipple, assigned to other duties.

OBITUARY.

William E. Hackedorn, formerly General Counsel of the Lake Erie & Western, died on November 26 of cerebral hemorrhage.

Railroad Construction.

New Incorporations, Surveys, Etc.

Atlanta, Birmingham & Atlantic.—An officer writes that the only work now under way is on the extension from Pelham, Ala., to Mulgay, 28.5 miles; grading is about finished and track laying and bridge work will soon be started. (Oct. 16, p. 1175.)

Buffalo Creek & Gauley.—An officer writes that this company is completing arrangements to build with the company's men an extension from Cressmont, Clay county, W. Va., northeast to Huttonsville, 99 miles. J. D. Bradley, Superintendent, Clay, W. Va. (R. R. G., March 13, p. 390.)

Chicago, Rock Island & Gulf.—An officer writes that surveys are now under way for the proposed extension from Graham, Tex., southwest to Haskell, about 75 miles. (Nov. 13, p. 1373.)

Clinton & Oklahoma Western.—An officer writes that this company, which was recently chartered in Oklahoma with a capital of $500,000, proposes to build a line from Clinton, Okla., northwest for about 200 miles, also southeast from Clinton an additional 200 miles. The projected route is from Clinton northwest to Trinidad, Colo., and from Clinton southeast to Lehigh or some other point in the coal fields of Oklahoma. Active construction work is expected to begin about January 1. T. J. Nance, Vice-President, and J. H. O'Hearn, engineer in charge, both of Clinton. (Nov. 20, p. 1418.)

Crows Nest & Northern.—This company has filed surveys with the British Columbia government for a line to be built from Crows Nest, B. C., to Crown, over 12 miles. J. A. Williams, President, and C. O. Diffenderfer, Chief Engineer, Spokane, Wash. (R. R. G., March 27, p. 461.)

Dakota, Kansas & Gulf.—Incorporated in Kansas with a capital stock of $3,000,000, to build a line from Beloit, Kan., on the Missouri Pacific, northwest to Kearney, Neb., on the main line of the Union Pacific. The incorporators include: F. T. Lock, New York; C. E. Gardner and F. P. Larmon, both of Troy, N. Y.; C. W. Kibler and J. M. Patterson, both of Kearney, Neb., and W. H. Mitchell, of Beloit, Kan. The contract for the construction work is said to have been given to the Interurban Construction Co., L. M. Shaw, President, New York.

Delaware Tunnel Railroad.—An officer writes that contracts for the construction of this tunnel under the Delaware river will be let as soon as the general plans are completed. (Nov. 27, p. 1460.)

Dyersburg-Northern.—An officer writes that an extension is projected from Tiptonville, Tenn., to Bottom Number Nine, nine miles. R. M. Hall, President, Dyersburg, Tenn.

Franklin & Abbeville.—An officer writes that this company has projected an extension from David Junction, La., north to Youngsville, 15 miles, and from Franklin & Abbeville Junction south to Franklin, six miles.

Grand Trunk Pacific.—Construction work on the Lake Superior branch from Lake Superior Junction, Ont., southeast to Fort William, 210 miles, has been completed and the line opened for traffic. As soon as the permission of the National Transcontinental Railway Commission has been obtained, two mixed trains per week will be run each way. (Oct. 23, p. 1227.)

Great Northern.—The line from Fernie, B. C., through Hosmer and Olson to Michel, 20.9 miles, was opened for business on November 30. Connection is made at Michel with the Crows Nest Pass Coal Company's tracks.

Indian Creek Valley.—An officer writes that this company is making surveys for an extension from Roger Mills, Pa., north to Jones Mills, 10 miles. The extension is projected north from Jones Mills to Ligonier, an additional 16 miles. (R. R. G., March 20, p. 429.)

Kansas City, Paris & Gulf.—See Quitman & Great Northern.

Kansas, Southern & Gulf.—An officer writes that this company, operating nine miles of line from Blaine, Kan., south to Westmoreland, will probably start work in December on an extension which has been located from Westmoreland southwest to Manhattan, 21 miles. Contracts for the work have not as yet been let. (June 5, p. 47.)

Missouri Southern.—An officer writes that this company has projected an extension from Bunker, Mo., northwest to Salem, 28 miles. (R. R. G., March 13, p. 392.)

Northern Pacific.—The report of this company for the year ended June 30, 1908, says under date of October 6, that the Big Fork & International Falls has been finished and is now in operation from the terminus of the Minnesota & International Railway at Big Fork, Minn., northeast to International Falls on Rainy Lake river, 34.01 miles.

The Oregon, Washington & Idaho, being built jointly by this company and the Union Pacific from Texas Ferry, Wash., on the Snake river east to Grangeville, Idaho, is still under construction. The part of the line from Texas Ferry east to Lewiston, Idaho, 72.3 miles, is being built under the direction of the Union Pacific, and has been finished to a connection with the Northern Pacific line at a point near Lewiston. The necessary arrangements for joint station facilities at Lewiston are now being made, and will be completed soon. The extension from Cul de Sac, Idaho, southeast to Grangeville, 55 miles, is being built by the Northern Pacific. During the year 23.05 miles was finished from Cul de Sac to Vollmer. Track has been laid from Vollmer to Lawyer's Canyon, 27.12 miles. At this place a steel viaduct, 1,489 ft. long and 286 ft. high, has been finished and it is expected that the line will be completed to Grangeville early in November.

The Spokane, Portland & Seattle is a joint project of the Northern Pacific and Great Northern to give them a direct low-grade line to Portland, Ore., and is being built from Portland east to Spokane, Wash., along the north bank of the Columbia river, with a branch east along the Snake river to Texas Ferry, Wash., a total of 415 miles. The line between Kennewick, Wash., and Vancouver, 220.6 miles, has been finished, and work has continued on the lines east of the Columbia river. From Snake River Junction to Pasco, 26.09 miles, the grading and erection of wooden bridges is finished and track laid, and about 15 miles ballasted. From Snake River Junction to Spokane, 119.01 miles, grading is about finished from the Junction to Cheney and 38.90 miles of track laid. There remains to be finished steel viaducts at Cow Creek and at Box, Wilson, Bouvey and Burr canyons along the Snake river. All the grading has been finished, and work is now in progress on a few bridges and track laying between Snake River Junction and Riparia, 40.6 miles. All these lines, it is expected, will be finished this coming winter. The large bridges over the Columbia and Willamette rivers are about finished. Two freight houses have been put up at Portland, and work is under way on a warehouse and tracks on the company's water front property along the Willamette river.

During the year second main track work and revision of present grades, begun in June, 1907, in Wisconsin, was finished on 4.1 miles from Central avenue Y to Fourth street, Superior; and second main track work begun in May, 1907, from Superior to Central avenue on 3.9 miles was also finished. On the Great Northern line from Northtown Junction, Minn., to East St. Cloud, 61.65 miles, over which the Northern Pacific has trackage rights 20 miles of 90-lb. rail, also the ballasting of the entire line has been authorized. This work is now under way and is expected to be finished in the fall of 1908. Double-track work and revision of grades between Wadena Junction, Minn., and Lake Park, 54.8 miles, begun in April, 1906, was finished in 1907, with the exception of the grade revision of the old main line, from Oak Lake to Audubon, which is now under way, and is expected to be finished this autumn. Double-track work on new location from Lake Park to Glyndon, 26.83 miles, is to be finished in 1908.

The double-track work from Cassleton, N. Dak., to Wheatland, 6.06 miles, begun in 1907, was finished in the fall of 1907. The grade revision from Wheatland to Buffalo, 11.2 miles, is nearing completion and will be finished during 1908. Part of the surplus material taken from the cut on this section was used in revising the eastbound grade at mile post 38, two miles east of Buffalo, the rest of the excavated material is being used in making grades for the second main track

from Wheatland west. The new alternative line, north of Valley City, N. Dak., from Alta to Berea, 9.40 miles, was finished for freight operation in May, 1908, and all the work is to be finished before 1909. The new line has a maximum grade of 0.3 per cent. in each direction. The present line through Valley City with grades of 1 per cent. east, and 1.2 per cent. westbound, is to be continued in operation for local freight. This work will complete the revision of grades between Berea, N. Dak., and Staples, Minn., to three-tenths grade eastbound and four-tenths westbound, with the exception of the helper grade from Oriska to Alta on 4.5 miles.

In Montana, grade revision and double-track work between Livingston and the east end of the tunnel on Bozeman mountain has been finished, with the exception of the tunnel. The walls of the tunnel are lined and it is expected the roof will be finished by early autumn. The distance is reduced 1,142 ft. and curvatures 642 deg., westbound grade reduced from 2.2 per cent. to 1.8 per cent., and maximum curves from 8 deg. to 3 deg. The second track parallel to present main track from West End to Bozeman, 11.8 miles, has been finished. Grade revision and second track work from Garrison, west to Missoula, 69.1 miles, was much damaged by heavy floods during June, 1908, and will cause some delay in its completion. To the end of the fiscal year 55.7 miles of main track and 2.54 miles of side track had been laid. On the alternate line from St. Regis to Paradise, 21.8 miles, to eliminate mountain grades over Evaro Hill, grading is about finished, and track laid for 10 miles out of St. Regis. The work will probably be finished in 1908. Between De Smet and St. Regis, 72 miles, the work consists of revision and repairing the Coeur d'Alene branch from De Smet (which is six miles west of Missoula) west to St. Regis, is to be finished in 1908. All grading for change of line and grade is finished and track laid from White Pine Hill on 28.4 miles. Bridges and ballasting is expected to be finished in October, 1908. Grade revision work at Noxon, Heron and Cabinet Hills has been finished.

In Washington double-tracking and revising grades on present main track, between Auburn and Meeker, 7.5 miles has been finished to a point about two-tenths of a mile east of the bridge over the Puyallup river, about one mile from Meeker, and is expected to be finished this fall. All the grading for second main track and revision of grades between Vancouver and Kalama on 29.9 miles has been finished except some of the second track. To date 24.9 miles of main track have been laid, and ballasting is in progress.

NORTHWESTERN PACIFIC.—An officer writes that work is under way on a cut-off from Corte Madera, Cal., northeast to Green Brae, 1.4 miles. Surveys made for the extension of the main line from Willits north to Shively, 108 miles; also for the branch from the main line at Healdsburg northwest to Floodgate, 63 miles, where connection is to be made with the branch from Albion, on the Pacific coast. (Nov. 20, p. 1419.)

OCEAN SHORE.—This company is building a line from San Francisco, Cal., south to Vera Cruz, 79.5 miles, of which 47 miles are now in operation. An officer writes that work is under way by Lilly & Heins and the Humboldt Contracting Co., both of Santa Cruz, Cal., and the Ransome Crummey Co., of Oakland, Cal., building sections of this line from Tunitas, Cal., to Pescadero, seven miles; also from Scott Creek to Pescadero, 20 miles. Surveys made for an extension from Santa Cruz east to Watsonville, 19 miles. (Nov. 20, p. 1419.)

OREGON, WASHINGTON & IDAHO.—See Northern Pacific.

QUEBEC CENTRAL.—An officer writes that surveys are being made for an extension from St. George, Que., to St. Justine, 30 miles.

QUITMAN & GREAT NORTHERN.—An officer writes that this company is making surveys for a line from Paris, Tex., south to Mineola, 85 miles, and south of Mineola under the name Kansas City, Paris & Gulf, to Sabine Pass, 225 miles additional. The company wants to hear from reliable contractors in a position to form a construction company, to build the section from Quitman, which is 10 miles north of Mineola, south to Sabine Pass. The line has been located from Quitman to Mineola. M. J. Healy, General Manager, Quitman, Tex. (Oct. 23, p. 1227.)

ROARING FORK.—An officer writes that this company, which operates 7.5 miles of railway in Virginia, has made surveys for an extension from Roaring Fork, Va., to Big Black Mountain, five miles. E. L. Gobble, Chief Engineer, Blackwood, Va.

ST. MARYS & KINGSLAND.—An officer writes that it is expected work will be started soon, by the company's men, on an extension from Kingsland, Ga., northwest to Waycross, 48 miles. A further extension west is projected from Waycross to Nashville, 50 miles. The road is now in operation from St. Marys, Ga., on the St. Marys river, near the Florida boundary, northwest to Kingsland, 11 miles. L. Johnson, President, St. Marys.

SPOKANE, PORTLAND & SEATTLE.—See Northern Pacific.

THOMPSON RUN COAL & RAILROAD.—An officer writes that this company, operating four miles of railway in Pennsylvania from Thompson Run Mines to Ellwood Junction, has projected a six-mile extension.

TUSCARORA VALLEY.—An officer writes that surveys have been made for an extension from the present southern terminus at Blair's Mills, Pa., southwest to McConnellsburg, 27 miles.

UINTAH RAILROAD.—An officer writes that this company, operating 55 miles of railway from Mack, Colo., northwest to Dragon, Utah, has surveys made for an extension from Dragon northwest to Randlett, 65 miles. E. A. Grove, Superintendent, Mack, Colo.

UNION TERMINAL RAILWAY (St. Joseph, Mo.).—An officer writes that this company, operating a 12-mile terminal railway connecting all lines entering St. Joseph, proposes to lay two miles of additional tracks in St. Joseph.

WILLIAMSPORT & NORTH BRANCH.—An officer writes that surveys have been made for an extension from Bernice, Pa., to coal mines in the Bernice district, about four miles.

Railroad Financial News.

CHICAGO & MILWAUKEE ELECTRIC.—A new suit has been brought against this company by the Investment Registry, Limited, of London, England, which owns $954,000 bonds of the road, alleging that the proceeds from a $10,000,000 issue of bonds of the Chicago & Milwaukee Electric were used in a manner not approved by the bondholders. (Nov. 13, p. 1357.)

CHICAGO CITY RAILWAY.—The Illinois Trust & Savings Bank, Chicago, has bought $6,000,000 first mortgage 5 per cent. rehabilitation bonds of 1907-1927. There was previously outstanding $19,000,000. The proceeds of the sale of the total $25,000,000 bonds equals the maximum estimate of the company, and of the city engineers, for the complete rehabilitation of the road.

CHICAGO GREAT WESTERN.—Charles H. Tweed has been added to the bondholders' protective committee, John W. Castles, chairman. The other members of the committee are: Myron T. Herrick, Hugo Blumenthal and J. Horace Harding.

The preferred stock A, preferred stock B, and common stockholders' protective committee, John W. Castles, chairman, has extended the time for the deposit of stock to December 15, 1908.

CHICAGO RAILWAYS.—The following committee has been appointed to work out a plan to consolidate or unite under one management the surface electric railway companies, and possibly the elevated railways in Chicago. John J. Mitchell, John A. Spoor, Chauncey Keep, Henry A. Blair, W. N. Eisendrath, Wallace Heckman and Samuel Insull.

CHICAGO TERMINAL TRANSFER.—The stockholders' protective committee has received a binding offer for the preferred stock, the price being fixed at $20 a share, providing the committee deliver not less than 50,000 shares not later than January 1. No offer is made for the common stock. In 1907 the Baltimore & Ohio took an option running to December 31, 1907, on the stock at $25 per share but allowed the option to expire. There is $17,000,000 preferred stock and $13,000,000 common stock outstanding. The Baltimore & Ohio has secured permission from the courts to buy the

$15,000,000 outstanding bonds of the Chicago Terminal Transfer.

Cripple Creek Central.—Preferred stock aggregating $570,040 and common stock aggregating $512,300, held as collateral against loans made in Europe, are to be sold December 9 at public auction. There is $3,000,000 preferred stock and $2,500,000 common stock outstanding.

Delaware, Lackawanna & Western.—In addition to the regular 2½ per cent. quarterly dividend, an extra dividend of 10 per cent., payable December 15, has been declared. This is the fifth year that such extra dividend has been paid.

Denver & Rio Grande.—Blair & Co., William A. Read & Co., and William Salomon & Co., all of New York, have arranged to buy $17,500,000 first and refunding mortgage 5 per cent. bonds of 1908-1955. The proceeds of the sale of these bonds is to be used to retire $15,000,000 three-five year collateral 6 per cent. notes dated 1908 and sold to these bankers recently.

Erie.—This company has applied to the New York Public Service Commission, Second district, for permission to issue $30,000,000 collateral trust 5 per cent. 20-year bonds. The annual report for the fiscal year ended June 30, 1908, stated that a plan was under consideration for funding the coupons falling due during the next few years, so that the company can have the cash that would otherwise be paid out in interest for improvements and betterments.

Fort Dodge, Des Moines & Southern.—See Newton & Northwestern.

National Railroad of Mexico.—The readjustment managers are paying $10 per share to holders of certificates of deposit of the preferred stock, in accordance with the plan of December 14, 1907. (April 10, 1908, p. 526.)

Newton & Northwestern.—Judge McPherson, in the United States Circuit Court, on November 20 ordered the sale of the company's property under foreclosure of the first mortgage and funding mortgage. All of the $600,000 bonds secured by the funding mortgage and 98 per cent. of the $2,460,000 first mortgage bonds are owned by the Fort Dodge, Des Moines & Southern and have been pledged under its own mortgages.

Pennsylvania.—The 3½ per cent. convertible bonds of 1902-1912, of which there are $19,993,500 outstanding, may now be converted into stock at 70 without notice. Previously it was necessary to give 30 days notice and the bonds could only be converted into stock on any interest date. The par value of the stock is $50.

Sutro Bros. & Co., New York, are offering $500,000 Pennsylvania convertible notes at 99, yielding about 3.75.

Reading Company.—First mortgage 4 per cent. New York Short Line Railroad bonds amounting to $1,500,000 have been sold by the Reading Company to Drexel & Co., Philadelphia, Pa. The mortgage securing these bonds is a first lien on the 9½-mile double-track cut-off between Cheltenham, Pa., and Neshaminy Falls.

St. Louis & San Francisco.—The 4½ per cent. notes of 1903-1908, due December 1, 1908, of which there are outstanding $7,124,900, are being paid at the office of the Trust Company of America, New York. This is in accordance with the arrangement made by the railway company with Kuhn, Loeb & Co., New York.

Speyer & Co., New York, have bought $30,000,000 general lien 5 per cent. bonds of 1907-1927.

Wheeling & Lake Erie.—The trustee of the second mortgage income bonds of the Wabash-Pittsburgh Terminal has filed an intervention petition in the Wheeling & Lake Erie receivership case, the petition opposing the request of the New York Trust Co. to sell the bonds and equipment securing the $8,000,000 4 per cent. notes of 1905-Aug., 1908 of the Wheeling & Lake Erie.

White Pass & Yukon.—A dividend of 2 per cent. has been declared on the £1,375,000 ($6,875,000) stock. This dividend, with the 2 per cent. paid last July, makes the total dividend for the year 4 per cent., as compared with 5 per cent. in each of the three preceding years.

Equipment and Supplies.

LOCOMOTIVE BUILDING.

The Grand Trunk is in the market for 50 locomotives.

The Apalachicola Northern is considering the purchase of one locomotive.

The Pensacola, Alabama & Tennessee will purchase one locomotive early in 1909.

The Louisiana & Arkansas contemplates the purchase of new locomotives at an early date.

The Northern Railway of Brazil has ordered two locomotives from the Baldwin Locomotive Works.

The Pittsburgh & Lake Erie is reported in the market for five passenger locomotives. This item is not confirmed.

The Enid, Ochiltree & Western, A. E. Wiest, Vice-President and General Manager, Dalhart, Tex., expects to be in the market for locomotives next spring.

The Iowa & Omaha Short Line, G. W. Adams, President, Des Moines, Iowa, expects soon to be in the market for 12 locomotives of a standard type, and also three switching locomotives.

The Beaumont & Great Northern has ordered one simple 10-wheel locomotive from the Baldwin Locomotive Works. It will have cylinder dimensions of 18 in. x 24 in. and will weigh 110,000 lbs.

The Carolina, Clinchfield & Ohio has ordered six additional consolidation locomotives from the Baldwin Locomotive Works. The specifications for these locomotives are the same as for those reported in the *Railroad Age Gazette* of October 2.

The St. Louis Southwestern, reported in the *Railroad Age Gazette* of November 20 as having ordered 25 locomotives from the Baldwin Locomotive Works, has increased this order to 31, which includes 20 consolidation, 6 Atlantic and 5 mogul locomotives.

CAR BUILDING.

The Boston & Albany is in the market for two postal cars.

The New York Central & Hudson River is in the market for five postal cars.

The Louisiana & Arkansas contemplates buying new cars at an early date.

The Pensacola, Alabama & Tennessee will purchase 25 flat cars early in 1909.

The Dairy Shippers' Despatch, Chicago, is figuring on 100 thirty-ton refrigerator cars.

The Detroit United (Electric), Detroit, Mich., is in the market for 11 sets of trucks.

The Wichita Railroad & Light Co., Wichita, Kan., is in the market for six double-truck trailer cars.

The Indianapolis Traction & Terminal Co., Indianapolis, Ind., is asking prices on 50 electric cars.

The Apalachicola Northern is considering the purchase of one coach and one combination passenger and baggage car.

The Milwaukee Northern (Electric), Cedarburg, Wis., has ordered about 10 trucks from the Baldwin Locomotive Works.

The Russell Wheel & Foundry Co., Detroit, Mich., is reported to have received an order for 40 logging cars. This item is not confirmed.

The Canadian Northern has ordered 750 thirty-ton box cars from the Canada Car Co.; 1,000 box and six straight baggage cars from Rhodes, Curry & Co.

The Enid, Ochiltree & Western, H. E. Wiest, Vice-President and General Manager, Dalhart, Tex., expects to be in the market for rolling stock next spring.

The Seaboard Air Line is asking prices on 500 thirty-ton steel underframe ventilated box cars, 200 all steel 50-ton phosphate cars and 50 forty-ton ballast cars.

The Delaware, Lackawanna & Western is asking prices on 300 forty-ton steel hopper and 500 box cars. This equipment was mentioned in the *Railroad Age Gazette* of November 27.

The Pittsburgh & Lake Erie has ordered, in addition to the cars reported in the *Railroad Age Gazette* of November 20,

500 fifty-ton all-steel coal cars from the American Car & Foundry Co.

The Hudson & Manhattan has ordered 50 all-steel passenger cars from the Pressed Steel Car Co. These cars will be 48 ft. long, will have American Locomotive Co. trucks and a seating capacity of 44 passengers.

The New Orleans Great Northern, reported in the *Railroad Age Gazette* of November 27 as being in the market for 300 thirty-ton steel underframe box cars, has ordered this equipment from the Standard Steel Car Co.

The St. Louis Southwestern, reported in the *Railroad Age Gazette* of November 6 as making inquiries on a number of passenger cars, has ordered 35, including day coaches and chair cars, from the American Car & Foundry Co.

The Roscoe, Snyder & Pacific, Roscoe, Tex., reported in the *Railroad Age Gazette* of September 25 as being in the market for rolling stock, has ordered one coach and one combination passenger and baggage car from the Ralston Steel Car Co.

The Birmingham Southern, reported in the *Railroad Age Gazette* of October 2 as being in the market for 150 fifty-ton hopper bottom cars, has ordered 175 fifty-ton all-steel dump and 26 fifty-ton all-steel gondola cars from the Pressed Steel Car Co.

The United States Steel Corporation has ordered 275 all-steel, fifty-ton gondola cars from the Pressed Steel Car Co. This equipment is for the American Steel & Wire Co., and is a part of the 3,000 cars reported in the *Railroad Age Gazette* of November 27.

The Southern Pacific is preparing specifications for a large number of electric cars for use on its Alameda and Oakland moles in San Francisco bay. Bids will be asked about January 1 for 80 or 85 cars and a number of additional cars will be ordered at a later date.

The Newburg & South Shore, reported in the *Railroad Age Gazette* of November 20 as soon to be in the market for 275 freight cars, has ordered 200 fifty-ton all-steel gondola, 50 fifty-ton general service steel gondola and 25 fifty-ton steel underframe box cars from the Pressed Steel Car Co.

The Harriman Lines, reported in the *Railroad Age Gazette* of November 27 as having ordered 1,870 fifty-ton steel underframe box cars from the American Car & Foundry Co., will divide these cars as follows: Oregon Railroad & Navigation Co., 1,000; Southern Pacific, 500; Central Pacific, 370.

The Iowa & Omaha Short Line, G. W. Adams, President, Des Moines, Iowa, expects soon to be in the market for 25 passenger cars and complete freight equipment. The installation of a semi-interurban system is also under consideration and if carried out the company will be in the market for either gasolene motor or electric storage cars.

The Carolina, Clinchfield & Ohio, reported in the *Railroad Age Gazette* of November 13, has ordered 1,500 fifty-ton hopper bottom steel coal cars, 500 fifty-ton twin drop bottom steel gondolas and 250 thirty-ton steel underframe box cars from the Pressed Steel Car Co. An order has also been placed with the Harlan & Hollingsworth Corporation for 12 steel underframe coaches.

The Live Poultry Transportation Co., Chicago, has given a contract to the American Car & Foundry Co. for rebuilding 100 fifteen-ton poultry cars. The work will be done at the Peninsular shops, Detroit, Mich., and all the cars are to be completed by May, 1908. The company says that the life of the superstructure of this type of equipment is only about eight years.

The Chicago, Rock Island & Pacific, reported in the *Railroad Age Gazette* of November 27, is preparing specifications for 70 passenger cars. It has not been finally decided what the apportionment of this equipment will be, but it will be about as follows: Thirty day coaches, 20 baggage cars, 6 combination baggage and express, 6 baggage and mail, 5 chair, 2 mail and one observation car. Recent press reports regarding this equipment are misleading in saying that these cars will be all-steel construction. The underframes and side framing will be all-steel, and all or a part of the baggage and combination cars may be of all-steel construction. It is expected that contracts will be let in from two to three weeks. The purchase of additional freight equipment is not under consideration at this time.

IRON AND STEEL.

The Wheeling & Lake Erie is in the market for 3,500 tons of structural steel.

The Wisconsin Central has ordered 3,000 kegs of spikes from the Illinois Steel Co.

The Minneapolis, St. Paul & Sault Ste. Marie has ordered 6,000 tons of rails from the Illinois Steel Co.

The Terminal Railroad Association of St. Louis has ordered 2,500 tons of rails from the Illinois Steel Co.

The Port Clinton Short Line, a new railway project in Ohio, has ordered 3,080 tons of structural steel from the Carnegie Steel Co.

The Manistee & Northeastern, reported in the *Railroad Age Gazette* of November 27 as being in the market for 4,000 tons of rails, has ordered 3,000 tons from the Illinois Steel Co.

The St. Paul Bridge & Terminal Co., reported in the *Railroad Age Gazette* of November 20 as getting prices on 900 tons of structural steel for a bridge at Minneapolis, Minn., has ordered 950 tons from the American Bridge Co.

RAILROAD STRUCTURES.

BREWSTER, OHIO.—The Wheeling & Lake Erie has completed plans for a new roundhouse and shops. Actual work is to begin about January 1.

KANSAS CITY, MO.—See note on page 1493 regarding status of plans for union passenger station.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Co. announces that it will build car storage houses at Fond du Lac avenue, Thirty-fifth and Locust streets, during the coming winter. The building will be of brick, stone, concrete and steel construction, and will have a capacity of 200 cars. It is the intention to abandon the present car barns at Twelfth and Wright streets, and at Twenty-seventh and Chestnut streets.

PLEASANTON, CAL.—See Stockton, Cal.

SAN ANTONIO, TEX.—The contract for the two new freight depots to be built by the Galveston, Harrisburg & San Antonio has been given to the Broows-Gordon Construction Co., Houston, Tex. (Nov. 27, p. 1459.)

SAN FRANCISCO, CAL.—See Stockton, Cal.

STOCKTON, CAL.—The Western Pacific has let the contracts for new passenger stations to be built at Stockton and Pleasanton, Cal., both of which are to be of the mission type of architecture. Contracts have also been let for building a new freight ferry slip at the San Francisco terminal. (See Oakland, Cal., Nov. 13, p. 1366.)

TEMPLE, TEX.—The Gulf, Colorado & Santa Fe is taking the preliminary steps toward the erection of a new $65,000 passenger station, upon which work will begin about January 1. (Aug. 28, p. 830.)

SIGNALING.

The Chicago, Rock Island & Pacific has ordered from the Union Switch & Signal Co. material for automatic block signals for 500 miles of road. They will be electric motor semaphore signals, normal clear. The Rock Island intends to install them with its own forces. In the recent contract for something over 700 miles of signaling on the Frisco lines, the Union Switch & Signal Co. not only furnishes the material but installs the work.

The Chicago & North-Western has ordered the material for Hall automatic block signals for the 58 miles of its line, double track, from Maple River Junction, Iowa, to Logan. The signals will be enclosed disks, normal clear. The block section will be about two miles long and the distant signals will be on separate posts, usually 4,000 ft. in the rear of the home. When this apparatus is installed, the North-Western will be equipped with Hall disks from Chicago to Council Bluffs, and a passenger can ride under automatic block signal protection from Jersey City, opposite New York, to Oakland, opposite San Francisco, with the exception of 110 miles of the

Southern Pacific between Truckee, Cal., and Rocklin, which is worked by the controlled manual system (electric train staff).

Pennsylvania to Creosote Ties.

The Pennsylvania Railroad has decided to treat with creosote all ties which shall be used on its main tracks. Up to very recently, the abundance of available timber in the eastern section of the country had rendered unnecessary such a policy, but the increasing scarcity of available timber in recent years has caused the company to make a most thorough inquiry into the question of what policy should be pursued in order to secure an economical supply of cross-ties in the future.

To this end the company, some two years ago, undertook tree-planting upon a large scale. Since that time it has set out some 2,425,000 trees and has handled this year some 625,000. Extensive planting of trees and shrubbery for ties, lumber and ornamental purposes is being made on land owned by the company in various parts of Pennsylvania and New Jersey.

In order to provide still more completely against the future, a contract has just been placed for a tie-treating plant at Mt. Union, Pa., and, in addition, for two large creosote storage tanks to be located at Greenwich Point, Philadelphia, Pa. The Mt. Union plant will be the first creosoting operation undertaken on a large scale by an eastern railroad. This plant will be equipped with a cylinder 130 ft. long and a little more than 6 ft. in diameter. There will also be the necessary pumps, boilers, compressors and storage tanks. By reason of the fact that ties require from six to nine months' seasoning in the open air before being treated, a storage yard of a capacity of one-half million ties will be provided adjoining the creosoting plant. The plant will be equipped to treat between 1,500 and 2,000 ties daily, or some 500,000 a year.

In addition to the regular treating plant, there will also be installed at Mt. Union a small cylinder for the purpose of making experiments in treating the various kinds of wood available in Central Pennsylvania.

It is estimated that proper treatment will increase the life of ties from two to three-fold. The Pennsylvania uses from 3,500,000 to 4,000,000 ties each year for renewals and new work. The average life of these red oak and chestnut ties under present conditions is from three to four years, while white oak lasts from seven to eight years. It is estimated that tie-treating will increase the life of these ties to at least 20 years. The Pennsylvania's tie and lumber requirements now strip the timber from some 50,000 acres annually. It is estimated that by properly treating with preservatives even a part of this timber, its life will be so increased that perhaps 25,000 acres will supply the company's requirements.

Oil Fuel on the Illinois Central.

At a conference between Mayor Busse of Chicago and officers of the Illinois Central on November 30, the Mayor was notified that the Illinois Central will experiment with coke and oil as fuels on their lines in Chicago, with a view to the abatement of the smoke nuisance. L. C. Fritch, Assistant to the President of the Illinois Central, said that 100 tons of coke had been bought for this purpose and that the company would use oil which it had discovered on its own property near Effingham, Ill. The Mayor asked if it was to be understood that if the experiments with coke and oil showed that their use would reduce the smoke nuisance the company would indefinitely postpone electrification. Mr. Fritch replied that the company did not wish to be so understood; that other fuels were to be used in place of coal only until electrification was found feasible. Mr. Fritch said that the electrification of the Illinois Central suburban lines in Chicago would be a relatively simple matter but that the electrification of its freight tracks would be much more difficult. The officers of the Illinois Central who attended the conference were: J. T. Harahan, President; L. C. Fritch, Assistant to the President, and A. S. Baldwin, Chief Engineer. They were accompanied by F. W. Sprague, Electrical Engineer, who is acting in a consulting capacity to the road in connection with the proposed electrification of its Chicago terminals.

Supply Trade News.

The Ernst Wiener Company, New York, has removed its general offices to 50 Church street.

The freight car shops of Rhodes, Curry & Co., Amherst, N. S., were damaged by fire to the extent of $150,000 on November 24.

The Wagner Electric Manufacturing Co., St. Louis, Mo., has an order from the Wabash for supplying the Fort Wayne, Ind., locomotive repair shops with Wagner polyphase motors.

The Railroad Automatic Track Inspector Co., Tacoma, Wash., has received a conditional order for one of its automatic track inspectors to be shipped to Richley-Tuddenham & Co., Buenos Ayres, S. A.

C. B. Lowry, General Manager of the American Creosoting Co., Chicago, was killed on November 12 in a train wreck. In the item to this effect in our issue of November 20, his name was given as G. M. Lowry.

A fire in the lumber yard of the J. G. Brill Co., Philadelphia, Pa., on November 29, destroyed much valuable hardwood and damaged the wood-bending room, pumping station, lumber shed, dry kilns and several freight cars. The fire, however, did not cause a day's shutdown.

At a meeting on November 30, the stockholders of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., elected a board of directors and a proxy committee consisting of those approved by the various committees. The names were given in the *Railroad Age Gazette* of November 27.

On December 23 a tablet in honor of the French scientist, Andre-Marie Ampere, which has been set up in the Delaware, Lackawanna & Western station at Ampere, N. J., by S. S. Wheeler, President of the Crocker-Wheeler Co., Ampere, N. J., was unveiled by Monsieur Jusserand, the French Ambassador.

James Gayley, First Vice-President and a Director of the United States Steel Corporation, has resigned. Alfred Clifford succeeds him as a Director, but no Vice-President has yet been elected. Mr. Gayley is to devote his time to his various business interests, and will have offices at 71 Broadway, New York.

The Latrobe Steel & Coupler Co., Philadelphia, Pa., is erecting two large additions to its plant at Melrose Park, Ill., which will increase its capacity 50 per cent. The structures will have dimensions of 50 ft. x 275 ft. and 40 ft. x 200 ft., and will be of steel construction. The Riter-Conley Manufacturing Co., Pittsburgh, has the contract.

The Teredo-Proof Paint Co., New York, has an order from the Charlotte Harbor & Northern for paint to treat 500 piles to be used for a wharf in Florida. The paint is to be applied in four coats, which, it is considered, will be sufficient to protect the timber from teredos. The cost of material and application will be about 10 cents per lineal foot.

S. Hoffmann, who is representing Wilhelm Schmidt, of Cassel, Germany, reports that the Schmidt system of superheating has now been applied to about 3,600 locomotives and that the Paris-Orleans Railway has just signed a contract with the Schmidt Superheating Co., of London, for equipping 100 locomotives with the Schmidt smoke-tube superheater.

The Isthmian Canal Commission, Washington, D. C., is asking bids up to December 21 on seven Scotch marine boilers, Portland cement, tool steel, galvanized iron or steel roofing, brass, bolts, arch bars and other repair parts of cars, pipe, valves and other plumbing fittings, rope, wire, reamers, and other machine and carpenters' tools. (Circular No. 482.)

The Draper Manufacturing Co., Port Huron, Mich., has recently sold pneumatic flue welders to the following: New York, Ontario & Western, Middletown, N. Y.; Temiskaming & Northern Ontario, North Bay, Ont.; Wolvin Steamship Line, Texas City, Tex.; New York Central & Hudson River, Depew, N. Y., and Port Huron Engine & Thresher Co., Port Huron, Mich.

At the annual meeting of the stockholders of the Cement

Products Exhibition Co., Chicago, the old officers and directors were re-elected, with the exception of C. H. Wood, Secretary-Treasurer and Director, who resigned and was succeeded as Director by C. A. Whyland, of the Elk Cement & Lime Co., and as Secretary-Treasurer by J. U. C. McDaniel, of the Chicago Portland Cement Co.

The Automatic Switch & Scale Co., Boston, Mass., has been incorporated with a capital stock of $50,000 to manufacture and sell overhead tramways, switches and scales. The officers of the company are: President, Frank Negro, 659 Saratoga street, East Boston; Treasurer, Walter L. Clark, 9 Howard avenue, Melrose, Mass., and George M. Faulkner, 1024 Commonwealth avenue, Boston.

The Russell Car & Snow Plow Co., Ridgway, Pa., recently shipped a size 6 pedestal electric snow plow to the Bangor Railway & Electric Co., Bangor, Me.; a size 2 double-track plow to the Buffalo, Rochester & Pittsburgh at Rochester, N. Y.; a size 6 pedestal electric plow to the Lewiston, Augusta & Waterville Street Railway at Augusta, Me., and a size 6 combination car and snow plow with double-track steel noses to the Ottawa Electric Co., Ottawa, Canada.

Frederick C. Bartels, of the Carbolineum Wood Preserving Co., New York, has been transferred from St. Louis, Mo., to New York as southern representative; Robert L. Felser has been made Pennsylvania representative; Julius Perlowitz, Connecticut and Rhode Island representative, and Louis Edward Rusch, New York City representative, all with headquarters at New York. Edwin Scheftels has been transferred from New York state to the Milwaukee, Wis., office.

Joseph A. MacLennan has resigned his position at the Philadelphia works of the Link-Belt Company, Nicetown, Philadelphia, Pa., to become President of the Wilmot Machinery Co., New Orleans, La. Mr. MacLennan has been associated with the Link-Belt companies for over twelve years. During part of this time he was Chief Engineer of Woodward, Wight & Co., New Orleans agents of the company. He later returned to Philadelphia and was appointed Superintendent of the Link-Belt Company's shops in that city. He next represented the company as contracting engineer in the bituminous coal fields of Virginia and West Virginia. Mr. MacLennan's early training was in the erection department of the Wm. Cramp & Sons' Ship & Engine Building Co., Philadelphia, Pa.

The International Car Co., New Orleans, La., as reported in our issue of November 13, has approved plans for the erection of its new car plant at New Orleans. The buildings for which contracts are about to be let include a planing mill, 60 ft. x 75 ft.; machine shop, 60 ft. x 60 ft.; two open work shops, each 80 ft. x 600 ft.; power house, 60 ft. x 110 ft., and an office building, 60 ft. x 100 ft. The buildings will be of structural steel. Some changes in the personnel of the company have been made and the officers are now as follows: President, W. H. Bofinger; Vice-President and General Manager, A. T. LeBaron; Secretary, C. K. Barnes; Treasurer, A. Wagatha. The main offices of the company are in the Maison Blanche building, New Orleans. As previously reported, bids are also being received on the machinery for equipping this plant.

TRADE PUBLICATIONS.

Lockers.—Merritt & Co., Philadelphia, Pa., has just issued a catalogue, illustrating and describing expanded metal lockers, for use in railway machine shops, cloak rooms, etc.

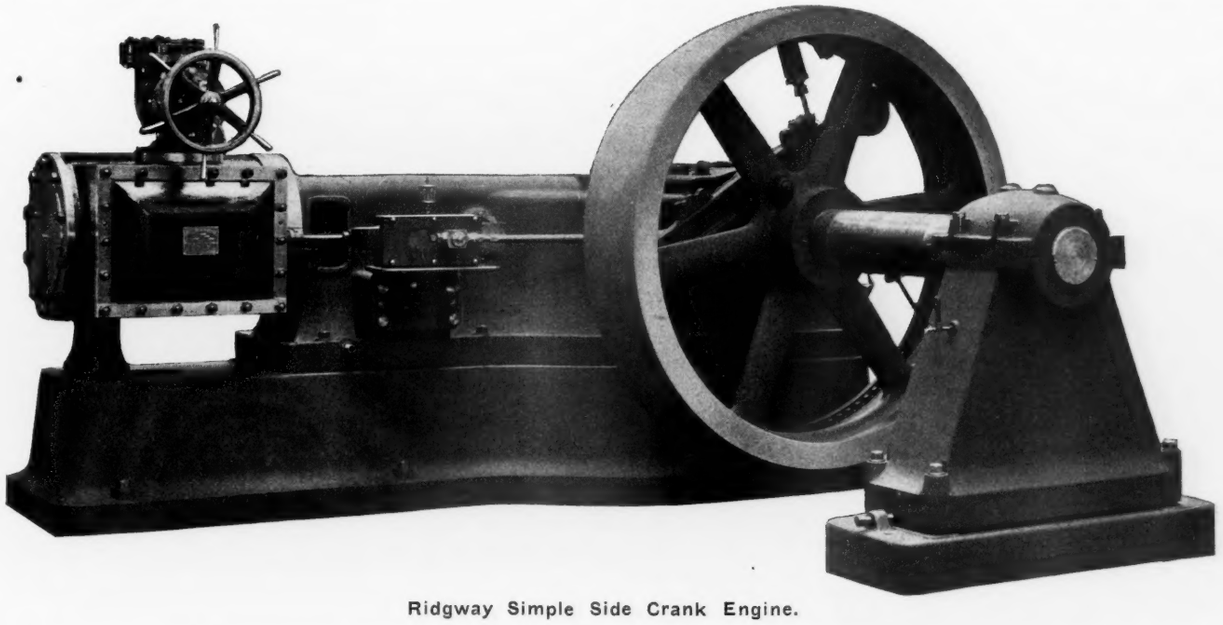
Steel and Iron.—The November Blue Book and Stock List of the Scully Steel & Iron Co., Chicago, contains a complete list of its iron working machines, tools, appliances, iron and steel supplies, also valuable and accurate reference tables. The Blue Book contains 240 pages and the monthly Stock List 96 pages.

Technical Publicity Association.—The November bulletin of this association has, among other interesting matter, some notes in regard to foreign advertising, by C. S. Redfield, Advertising Manager, Yale & Towne Manufacturing Co., New York, and President of the association. Mr. Redfield was in Europe for several months last summer.

Encyclopedia of Civil Engineering.—The American School of Correspondence, Chicago, is distributing literature descriptive of its Cyclopedia of Civil Engineering and making a special Christmas offer for the purchase of this work. The regular price of the eight volumes is $48. The special price is $24, including a year's subscription to the *Technical World Magazine*. This offer expires on December 25.

Ridgway Side Crank Engine.

The accompanying illustration shows a design which embodies the latest improvements in the side crank engines built by the Ridgway Dynamo & Engine Co., Ridgway, Pa. This engine is designed for simplicity, strength and quality. All parts are made to standard gage and are interchangeable. Each engine is erected on the testing floor at the factory, where a 10 to 24-hour test under full and overload conditions is run. After a satisfactory test the engine is then dismantled and packed for shipment.



Ridgway Simple Side Crank Engine.

The bed is of heavy design throughout, with the metal so dis-

tributed as to bring the heaviest sections in line with the greatest strains. The main part of the bed is of a box section having bored guides of large diameter. At the cylinder end of the head a removable partition is provided with sectional packing around the piston rod to prevent oil from being thrown against the end of the cylinder. Between the cylinder and the partition is a well in which the drip from the stuffing box is caught. The crank disc is covered with an oil tight guard of light steel, hinged at the top. The main bearing on all sizes is of the quarter box type. The shells are lined with babbit, tightly fastened in place and bored in accurate jigs, interchangeable in engines of the same size. Horizontal adjustment is secured by a wedge and vertical adjustment by drawing down the cap. The top and bottom shells are interchangeable and all may be removed without taking the shaft out of the bed. The connecting rod is forged, open-hearth steel, designed with a minimum safety factor of fifteen. The straps at both ends are slotted out of solid forging. The wrist pin box is solid phosphor bronze, while the crank pin box is lined with babbit. Both ends are adjusted by the wedge and bolt method. The cast steel cross head body is of a most substantial design. The shoes are cast iron, faced with babbit. The upper shoe is bolted solidly to the body, while the lower shoe is adjustable. Four hollow bolts pass through the crosshead body, and inside of these bolts are placed the cap bolts which hold the shoe. Both top and bottom shoes may be adjusted by the use of shims. The wrist pin is made of hard 50-point carbon steel and provided with keys so that it may be turned 90 deg. to compensate for wear. The cylinder is cast of a hard, close-grained iron, the walls being made thick enough for several reborings. The barrel of the cylinder is covered by a heavy polished cast iron lagging, and over the cylinder head and nuts is placed a false head, having a polished rim and center. The valve is the flat balanced type. It moves between the seat and a heavy pressure plate. In the pressure plate are cored ports, corresponding to those in the valve seat and connecting through side openings with the main ports, thus making a double ported valve. This construction gives an indicator card in which the steam line holds up well and cut-off is sharp. The pressure plate is held in place by lugs on the edges and a spring on the back. In case of water being carried into the cylinder, both valve and pressure plate lift from the seat and allow the water to pass into the exhaust. Relief valves are, therefore, not necessary.

The piston is a single hollow casting, strongly braced by ribs and made as light as is consistent with strength. It is packed with cast iron snap rings of special design, which prevent leakage without appreciable wear on the cylinder walls. The piston rod is extra large in diameter, made of best machinery steel. The rod and piston are joined by a force taper fit, supplemented by a jam nut. The rod screws into the crosshead with a long fine thread and is prevented from turning by a jam nut. The main shaft is a single forging of open-hearth steel. It is extra large in the bearings and is proportionately increased in the governor wheel hub. The crank disc is made of a special mixture of cast iron and steel, designated semi-steel, the result being a tough, close grained, hard material. On account of the large size of the crank pin and the shaft at the crank fit, the crank pin is cast solid with the disc. After the pin is turned and the shaft fit bored, the crank is forged to place on the shaft under hydraulic pressure and secured by a heavy key.

The important part of a high grade engine is the governor, as perfect regulation is very essential, especially in engines for driving electrical machinery. A long bar, called the inertia bar, having weights at each end, is pivoted at the center on a roller bearing. The main pin is made large and heavy and is of steel, hardened and ground. The inertia bar is lined with hardened steel bushings and the space between pin and bushings is filled with hardened steel rollers. This insures a minimum of friction and the bearing is subject to very little wear. This is the only bearing requiring lubrication, although it will run without attention for several weeks. To the hub of this bearing is clamped the eccentric, which is keyed in place and is also held by set screws. The eccentric and eccentric strap being split, are removable without disturbing the governor or the setting of the valve. A heavy coil spring is secured to the middle of one end of the bar. Opposite the spring is an oil dash pot, consisting of a cylinder with a loose fitting piston and a connecting rod bolted to the inertia bar. A by-pass with an adjustable opening allows the oil to circulate from one side of the piston to the other. The governor is reversible without the use of any extra parts.

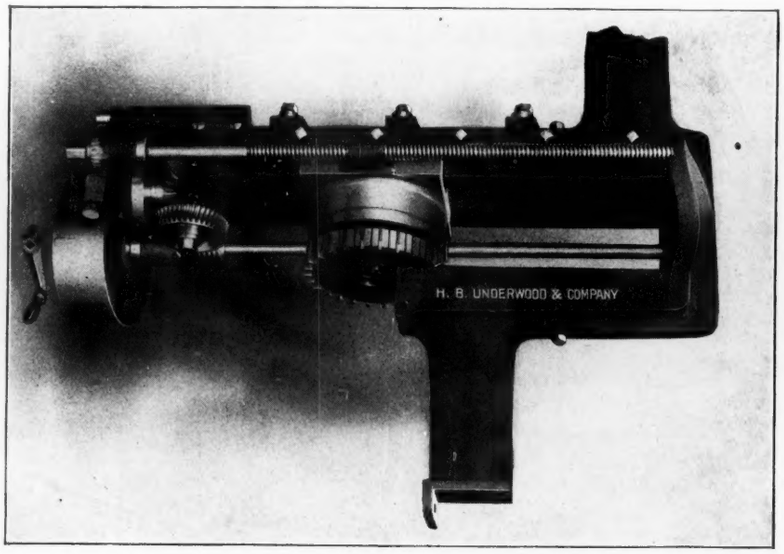
The valve gear is made simple and strong. The ram slide has a long bearing and is provided with horizontal and vertical adjustments. All pins and rods are of machinery steel and of generous proportions. The eccentric strap is lined with babbit. The bearing at the slide is lined with a replacable bronze bushing, having a screw adjustment. The outboard bearing pedestal is built on liberal lines and made broad at the base to insure stiffness. The bearing is of the self-oiling, self-alining type. This latter feature eliminates outboard bearing trouble due to defective and bad alinement. Vertical adjustment is accomplished by special devices as used on the crosshead and applied to the four holding bolts at the base of the pedestal.

Two methods of lubricating this engine are provided. In the first, the "splash system," the crank pit is filled with oil, which the disc throws in an almost steady stream over the crosshead and guides. Oil from the upper guide is wiped off by the top crosshead shoe and flows through passages and pipes to the crosshead pin. Pockets on the inside of the crank guard collect quantities of oil which are also led to the main bearings and to the crank pin. This system is furnished, unless otherwise specified. The second system uses a small but very efficient filter placed in one side of a tank, which is mounted on the sub-base below the slide bracket. In the other side of the tank is a valveless pump driven by a cam on the valve gear ram. This cam is so designed as to give a full stroke regardless of the travel of the ram. All oil from the bearings flows to the crank pit, from which it is piped to the filter, then passes to the pump chamber and it is pumped to a large tank on top of the bed. From this tank the oil flows through nickeled piping to each bearing. Sight-feed valves are placed in each pipe near the tank so that the supply may be shut off or regulated.

This engine is built in the simple, tandem and cross-compound types. In the compound types, the low pressure valve is of the balanced type, though slightly modified from the one previously described. On tandem engines, both valves are driven by the governor, the low pressure directly and the high pressure by a tail-rod on the low pressure valve. On cross-compound engines, the high pressure valve is driven by the governor and the low pressure by a fixed eccentric on the main shaft, otherwise the valve gear is identical for each cylinder.

Truck Side Frame Facing Machine.

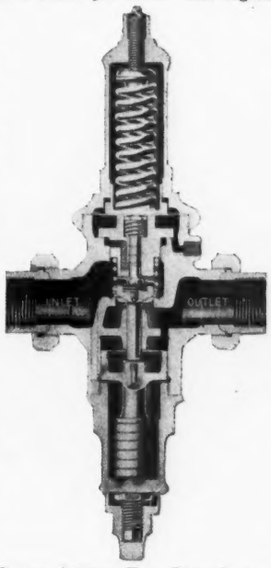
The portable facing machine, shown in the half-tone herewith, was designed for truing up the pedestal bearings on car truck frames, and is said to be a strong, powerful tool. The inserted blade milling cutter, made of high speed steel, has an adjustment of 1½ in. to allow for working on different widths of jaws and also for different depths of cut. The driving is effected by a worm and worm-wheel geared 42 to 1, which gives power and smoothness. A large number of different feeds may be used. The bed of the machine, carrying the sliding head and milling cutter, is made in the form of a chuck, with T-slots on both the top and bottom edges of the back side for holding the tool rigidly to the pedestal. Adjusting screws pass through and clamp the whole device to the back of the leg without springing the bed or the work. Six set screws along the top and bottom edges of the machine hold it against lateral movement and this, in conjunction with the clamps, hold the entire machine firmly to the work. By placing wedge-shaped pieces in the chuck, the machine will mill the pedestal jaw having a taper equally as well as the parallel side. The regular cutter is 8¾ in. in diameter and capable of taking a deep cut. Ordinarily this machine is belt-driven, but the end of the drive shaft can be fitted for using a portable air machine. These side frame facing machines are made by H. B. Underwood & Co., Philadelphia, Pa.



Underwood Side Frame Facing Machine.

Mason Steam Fan Regulator.

The Mason steam fan boiler pressure regulator, shown in the accompanying half-tone, is used to control steam-driven fans on either forced or induced systems to maintain a uniform boiler pressure. The regulator varies the speed of the engine according to the requirements of the plant. These may also be used for controlling steam jet blowers. As it is customary to allow a fan engine to turn over slowly when steam is up in order that it may respond promptly when steam is turned on full, the regulator is fitted with an adjustment to meet this condition.



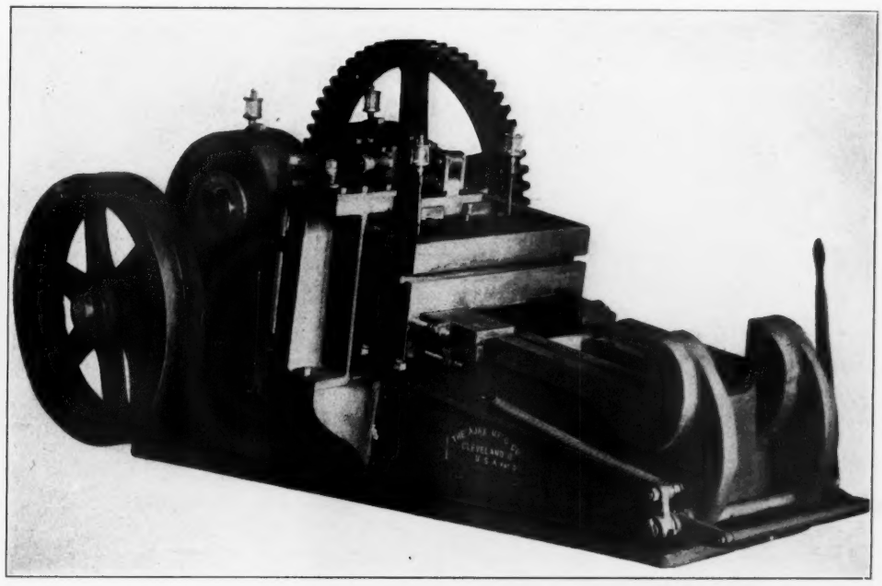
Mason Steam Fan Regulator.

Steam pipes should be thoroughly blown out before placing the regulator in the line, in order to remove all dirt or chips. If the pipes be new, steam should be allowed to flow through for some time in order to burn off all oil or grease. The valve is placed vertically in a horizontal pipe with the arrow on the valve body pointing towards the engine. The pressure connection is made with ¼-in. brass pipe to the port on the side of the regulator, from some point where steady pressure can be obtained, preferably the steam gage connection. These regulators are furnished with diaphragm springs suitable for ranges of boiler pressure from 5 lbs. to 50 lbs., 50 lbs. to 140 lbs., or 140 to 300 lbs. The diaphragm spring is the only one that requires changing for different boiler pressure, the others being unaffected by changes in pressure. The jacking screw in the bottom of the dash pot can be adjusted to raise the lower piston and hold the main valve open sufficiently to keep the engine from stopping entirely when the boiler pressure has reached the desired point.

High Speed Stop Motion Bulldozer.

A new style of bulldozer, or bending machine, has just been placed on the market by the Ajax Manufacturing Company, Cleveland, Ohio. This machine, which embodies a number of improvements over the old style of bulldozers, is a departure from the so-called slow-speed type. The main features of this latest design of machine are the rapid movement of the crosshead and the control which the operator has over the machine. The crosshead travels 60 r.p.m. for the No. 1, and 45 r.p.m. for the No. 6. The machine is equipped with both foot and hand levers, either of which throws the crosshead into motion and causes it to make one complete revolution after which it stops with the dies open. The bed is a steel casting set on an angle to facilitate placing stock in the dies. The gears are machine cut and all the wearing surfaces are lined with bronze. The crosshead has a long bearing surface and is provided with adjustable gibs for taking up the wear and maintaining the proper alinement. While this machine is designed especially for working cold iron, being primarily a bending machine, yet it can be used as a press or shear. These machines are built in six sizes. No. 1 size requires floor space 2 ft. 2 in. x 5 ft. The crosshead travels from 5 in. to 8 in. and has a face which is 4 in. x 16 in. The approximate weight of this machine is 2,200 lbs. No. 3 size requires floor space 3 ft. 6 in. x 10 ft. The crosshead travels from 5 in. to 10 in. and has a face which is 8 in. x 28 in. The approximate weight of this machine is 9,500 lbs. No. 6 size, which is the largest, requires floor space 7 ft. 6 in. x 15 ft. The crosshead travels from 5 in. to 14 in., and has a face 10 in. x 60 in. The approximate weight of this machine is 24,000 lbs.

An example of the work which can be handled on a No. 3 machine is an arch-bar, with an 8-in. pocket, of ⅝-in. x 3-in. metal, the four corners of which are bent at a single operation.

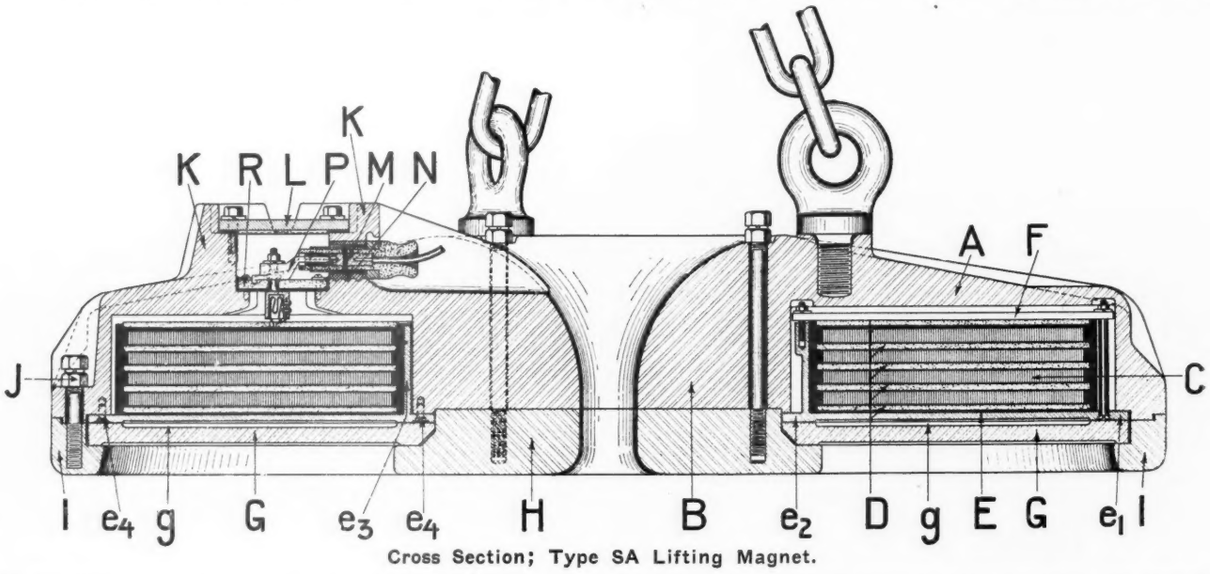

Ajax High Speed Stop Motion Bulldozer.

A New Design of Lifting Magnet.

A successful lifting magnet should withstand more severe abuse and rough handling in service than any other type of electrical apparatus. In operation it is suspended from the hook of a crane, which is frequently not equipped with a lowering brake, and the magnet may be lowered at high speed upon the material to be lifted. It will be swung against cars, charging boxes, piles of pig iron, etc., and must be capable of withstanding the blows and shocks which result. It must operate under all weather conditions, and its insulation must withstand, it is said, a voltage much higher than line voltage due to the inductive kick which occurs when the circuit of the magnet is opened. Its winding must be protected from the heat which is generated within it and also from external heat when the magnet is used in handling hot material. A typical cross-section of a type SA magnet is shown herewith, which illustrates an arrangement of the parts which experience has shown to meet the severe and exacting requirements of service. The body, or framework, A, of the magnet is an annular casting of special electrical steel heavily ribbed on both upper and outer surfaces. The ribs serve to add to the surface available for dissipating heat and are so disposed as to stiffen the magnet case and at the same time to add to the cross-section of the magnetic circuit. The core B is surrounded by the winding C, which is composed of a series of coils, each wound with a conductor in the form of a copper ribbon or strap, the turns of which are insulated with asbestos ribbon. Neighboring coils are separated and insulated by the non-combustible insulating discs D. The coils are wound upon a heavy brass form E, which serves to support the coils during the process of winding and insures coils of uniform and perfect shape, as there is no danger of springing or distorting the winding. After the last or uppermost coil is wound and the outer disc of insulation placed, the entire winding is rigidly clamped to the form by the radial straps F, which are bolted and locked in place, thus making the winding and the brass form which carries it a rigid unit. The completed winding is then dried in a steam heated chamber in a vacuum after which the winding is impregnated with a plastic insulating compound, first under the influence of a vacuum and then under air pressure, and finally is again dried in a vacuum, making a fire-proof, water-proof winding.

The form E is provided with an outer flange e_1 and an inner flange e_2, in addition to the central flange e_3, which supports the winding in central position. The inner and outer flanges are carefully finished and engage with finished surfaces on the inner and outer pole faces of the magnet case, thus completely sealing the lower face of the winding chamber, a water-tight joint being insured by clamping the flanges in place with screws e_4, spaced 4 in. apart around the flanges e_1 and e_2. Since the winding is clamped to the form E by the radial clamps F and the form E is clamped in the magnet case by the screws placed around its inner and outer edges, the winding is rigidly held in place, a result which cannot be reliably obtained by wedges or similar devices. With the winding thus assembled in the magnet case, the lower face of the coil form E is covered by a heavy annular plate of non-magnetic manganese steel G, which in turn is held in place by pole shoes H and I, bolted to the inner and outer poles of the magnet case. Both of the pole shoes have shoulders which protect the clamping bolts from shearing

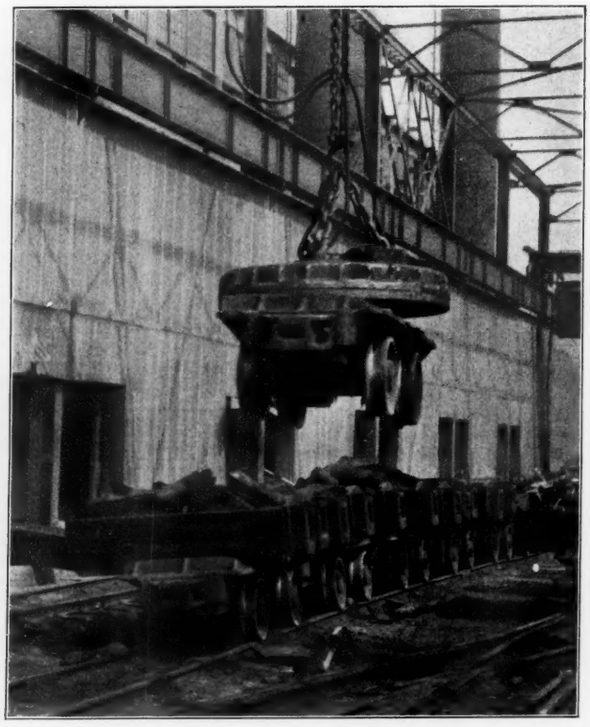
strains. The heads of the outer bolts J are located between adjacent ribs on the outer surface of the magnet case and are protected from abrasion. About two years ago a quality of manganese steel, for the wearing plates for lifting magnets, was found which was both hard and tough and at the same time practically non-magnetic. The manganese steel plate G has raised shoulders around its inner and outer peripheries, by which the plate is made to seat against the magnet poles and an air space or cushion is left under the winding at g. The shocks taken by the outer plate G are transmitted directly to the magnet frame instead of to the winding as would be the case if only a single bottom plate were used. The pole shoes are so disposed with respect to the outer plate G that none



Cross Section; Type SA Lifting Magnet.

of the clamping surfaces can become battered and the plate G may be readily renewed. It will be seen that the entire lower, or wearing face, of the magnet is renewable and that these renewals can be readily made in the field, there being no necessity for exposing, or disturbing, the winding or breaking the water-tight joint between the coil form E and the frame of the magnet. The arrangement of terminals also deserves attention, since trouble is certain to result if the terminal construction be weak. In type SA magnets, the terminal cavity is surrounded by raised walls K,K, cast integral with the magnet case and of such thickness as to be as strong as the magnet case itelf. The terminal cavity is closed at the top with a heavy steel cover L, which seats against a gasket to form a water-tight joint and is firmly bolted in place, the heads of the bolts being protected from abrasion by the walls of the terminal cavity. All of the terminal parts are thus enclosed in a water-proof steel box. The terminals themselves, as in the earlier type S magnets, are of the plug type, which permits of quick attachment and detachment of the service wires. Numerous improvements, however, have been made in the details of construction. The femals members M of the terminal are enclosed in an insulating tube so that a ground or short circuit cannot result even if the service wires are left hanging from the crane with the current on. Tne insulating tubes are each encased in a steel tube to prevent abrasion of the insulation, and these steel tubes fit closely in babbitted openings N in the side of the terminal chamber. The male members P of the plug connections are mounted on a heavy plate R of fire-proof insulating material which closes the entrance to the winding chamber and is seated on a gasket to make a water-tight joint. The plugs proper are separable from the terminals and may be removed, as can the plate R, without throwing any strain on the connections to the winding, which consists of loops of very flexible copper ribbon, placed in the box-like ends of the terminal studs. This construction permits of great flexibility and at

Lifting 2,525 lbs. of Machine Cast Pig Iron.



Lifting Truck Weighing 7,000 lbs.

the same time makes it impossible for the flexible leads which connect to the two ends of the magnet winding coming into accidental contact. The No. 4 type SA magnet, 40 in. in diameter, lifts substantially as much as older forms of magnets 50 in. in diameter with about the same current consumption, although it weighs 2,000 lbs. less. Comparing the performance of the two magnets, with equal lifts, on a five-ton crane having a 25 h.p. hoist motor, the No. 4 SA magnet has the advantage of of 2,000 lbs. in total load to be lifted or 20 per cent. of the total hoisting capacity of the crane. This will mean a saving in current consumption of 20 amperes on the part of the hoist motor and by virtue of this lower current consumption and lighter load, the hoisting speed will be higher and the amount of material handled in a given time will be materially increased. Proportionable increases in efficiency are shown by the No. 5 and No. 6 type SA magnet.

These lifting magnets are made by the Electric Controller & Manufacturing Co., Cleveland, Ohio.

Combination Pressure and Vapor Car Heating System.

The combination pressure and vapor car heating system below described, is the invention of Edward E. Gold, president of the Gold Car Heating & Lighting Co., 17 Battery place, New York City, who has devoted a great many years to the car heating business, having taken out over 100 letters patent.

The use of steam heat on passenger equipment cars has been quite generally attended by an undue elevation of the temperature inside of the car, and this is particularly true of the average sleeping car. With the old Baker heater the porter could run with a low fire at night, but with steam heat the ordinary coaches require even more pressure during the night than the day, and the train line pressure must be maintained sufficiently high to keep these cars comfortable. In moderate weather less heat is required than when low temperature prevails, but on the other hand the length of the train largely regulates the main pipe pressure.

Systems of regulation have been introduced, but most of them have failed either from complication of apparatus or from the necessity for frequent attention and manipulation. The simplest arrangements require a steam valve and a blow-off or drip cock, the latter principally for circulating the steam in heating a cold car and for promptly discharging it when cutting the car out of a train or laying up. The embryo trainman understands these simple features, even if he cannot regulate temperature under the guidance of a thermometer or the threats of the passengers, but when further attention is required the trouble commences and dissatisfaction ensues.

The majority of cars in this country are piped on the simplest systems, using two rows of 2-in. pipe on each side of the car and a steam valve and a blow-off cock for each section. With this arrangement, of course, the heating pipes must be either cold or at the temperature of the steam in the train pipe, even if this temperature is too high for comfort in moderate weather. This necessitates a continual heating and cooling by opening and closing the steam

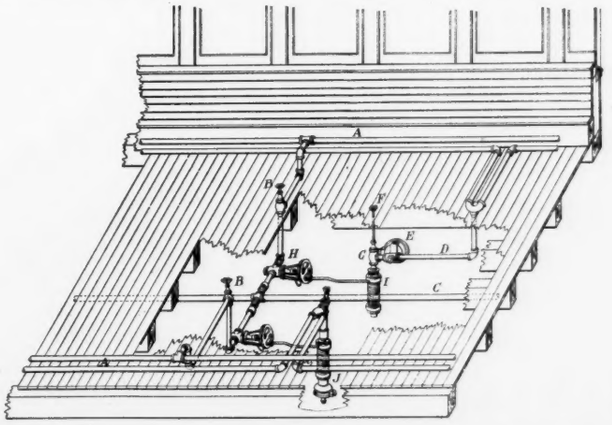


Fig. 1—Simple Heating Arrangement Converted Into a Combination System.

valve, the trap automatically discharging the condensed water as it accumulates. While the above facts are all well known, yet they have been gone over here in order to call attention again to the present difficulties, and the necessity for simple manipulation and easy control of any system that is destined to be acceptable to the railways.

The combination pressure and vapor system of the Gold Car Heating & Lighting Co. affords the opportunity to heat the car at different temperatures without increasing the manipulation or attention required by the trainmen or by making changes in the piping inside the car, the additional mechanism needed being merely the insertion of a special automatic valve in the steam line below the present steam throttle and a drip outlet connected to the blow-off cock, all of the attachments being applied below the bottom of the floor and requiring only a couple of hours' work for their addition to a car already equipped. The arrangement and operation will be made clear by reference to the following figures.

Fig. 1 represents a part sectional and interior view of a car which has originally been equipped with the simple heating arrangement above explained, and to which additional parts have been applied in order to convert the equipment into a combination system. The heating pipes are indicated at A A supplied by the steam valves B B, which obtain steam from the main steam line C. The water of condensation accumulates in the drop pipe D and is relieved as it

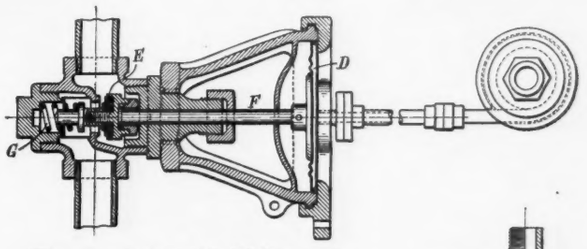
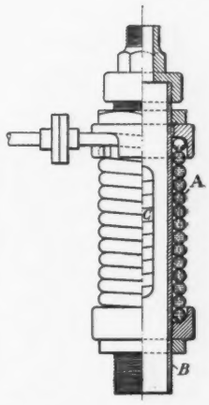


Fig. 2—Automatic Valve and Expansion Worm.



accumulates by the trap E. In case of desiring to heat the car quickly, or when blowing out at the end of a run, the hand wheel F is turned, opening the blow-off cock G. When it is desired to convert this direct steam system into a combined pressure and vapor system, it is merely necessary to insert the automatic steam valve H in the branch pipe between the main C and the steam valve B and to attach to the blow-off cock, immediately below its extremity, the expansion chamber, or worm, I.

The operation of the automatic valve and the expansion worm will be understood by referring to Fig. 2. The expansion worm, which is placed below the blow-off or drip cock and forms an extension to the same, consists of a spiral coil of copper piping A, surrounding the pipe B, which forms the extension to the drip cock. This pipe B has several slots, C, cut through to allow the hot water, escaping from the system, to trickle over the spiral copper pipe. This spiral pipe is filled with a liquid that boils at a low temperature and an extension of the pipe is connected to a diaphragm chamber, D, in the frame of the automatic valve. One or more joints are used to connect the

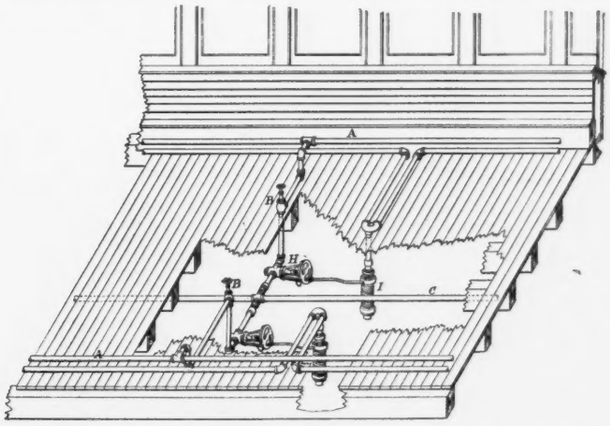


Fig. 3—Combination System for Moderate Heating Requirements.

worm and the diaphragm chamber, these joints being made of the well known type for securing tight connections under high pressures. The extension of the diaphragm D closes the steam valve E by means of the stem F, as soon as the liquid in the worm reaches a temperature at which it boils, and under which conditions the vapor generated has sufficient force to close the valve E against the spring G. When the liquid in the worm cools, which follows the cutting off of the steam supplied to the coils, the vapor condenses and the spring G forces the valve open, allowing a fresh supply of steam to enter the heating pipes and supply additional heat to the car.

By referring again to Fig. 1, it will be seen that under these conditions of operation, the heating system is run with a drip that is

open to the atmosphere continually and therefore there can be no pressure in any of the pipes in the car or beyond the valve H which can exceed atmospheric pressure, and also that the steam supply will be regulated by the automatic valve H admitting such quantity as may be necessary to keep the pipes sufficiently warm with steam of low pressure and corresponding temperature, and that this valve will be closed when the pipes and the drip become sufficiently heated to generate pressure in the spiral pipe. Under these conditions the temperature of steam in the heating pipes will be in the neighborhood of 200 deg. Fahr. and under conditions of moderate outside temperature or a moderate inside temperature desired at night, as in the sleeping cars, a comfortable temperature can be maintained without a continual opening and closing of the steam valve.

Supposing that colder weather existed and that it be desired to increase the heating capacity of the system. By closing the drip valve F, it will be seen that the water of condensation must pass through the trap E. This device is so well known as to need no description at this time, it being the same trap that has been used with the Gold system for years, and which is known as the horizontal trap or automatic Tee trap. It is sufficient to say that this is opened and closed by an expansion chamber, the movement of which is governed by the temperature of the water which passes over and around the same in escaping from the heating pipes, and as soon as the temperature is sufficient, the trap closes, thus retaining in the heating pipes such pressure as may be brought to them through the steam valve B. If, therefore, the pressure in the train line is in the neighborhood of 30 lbs. per sq. in., the temperature of steam in the pipes will be about 275 deg. Fahr. or about 75 deg. higher temperature than with the vapor system. With this arrangement all the drip or condensed steam will be compelled to pass through the trap E, as the valve G is closed and the coil or spiral will, therefore, become cool and the steam valve H will remain fully open.

It is thus seen that in order to change from the pressure or high temperature system to the vapor or low temperature system, it will be necessary only to open the valve G by means of the hand-wheel F, and that no further attention is required until more heat is desired. Thus at night time in a sleeping car when a lower interior temperature is desired, the porter need simply open the valve G, allowing the steam pipes to cool to about 200 deg. Fahr., thus maintaining a moderate temperature throughout the night.

In Fig. 1 the trap shown at E is of the horizontal type, but at J there has been indicated the vertical type of trap which has the copper spiral wound around the outside of the vertical pipe and produces an action precisely identical with that above described in connection with the horizontal trap.

There are other incidental advantages in connection with this combination system that are of considerable interest, relative to the cars standing in the yards in cool weather. Without the automatic valve H and the worm I, or as the direct systems are generally installed, when it is desired to heat the cars at the terminals before placing them in service, it is customary to connect with the steam pipe leading from the power plant or stationary boiler and open the drip cocks in order to quickly warm the cars. Ordinarily we soon have a strong current of steam emitted from these drip cocks which blows out from under the car, very rapidly destroying the varnish on the exterior surface, besides wasting steam and fuel without producing any beneficial results. With the automatic valve and the coil of the vapor system, however, as soon as the pipes become warm and steam issues from the drip, the valve will be automatically closed and only sufficient drip will be emitted to keep a circulation in the pipes. The economy, not only in fuel, but also in the protection to the exterior of the cars will be at once apparent, by considering the benefits gained by this system. Besides, in ordinary operation the alternate heating and cooling of pipes is not an economical way of providing heat for the cars, and the regulation of the drip by the trap is much more satisfactory and regular, providing that the proper temperatures can be maintained. The locomotive is often using steam to the limit of its capacity, and the saving of even a small amount of steam, as explained above, will be of assistance in maintaining the schedule. The same is true when changing engines, as the automatic valve practically takes care that sufficient steam is used to re-heat the cars but none is wasted.

Under conditions where cars operate continually in a warm climate, and only a moderate degree of heating is required, the vapor system alone may be used, as illustrated by Fig. 3. In this the arrangement of the interior pipes is the same as in Fig. 1, but there is no trap or drip valve used, so that the steam valve is the only piece of apparatus inside the car which is to be operated by the trainmen. It is simply a question of opening the valve B when desiring heat and closing it when no warmth is needed from the heating pipes. The automatic steam valve H and the spiral pipe I are used in the same manner as in Fig. 1, but, of course, under these conditions it is only possible to obtain an amount of heat equal to steam and atmospheric pressure. In many parts of the country this is sufficient and the other benefits, such as reducing the waste of steam when heating trains at terminals and the protection of varnish, will also be obtained. In Fig. 3 the same letters designate the corresponding parts as in Fig. 1.

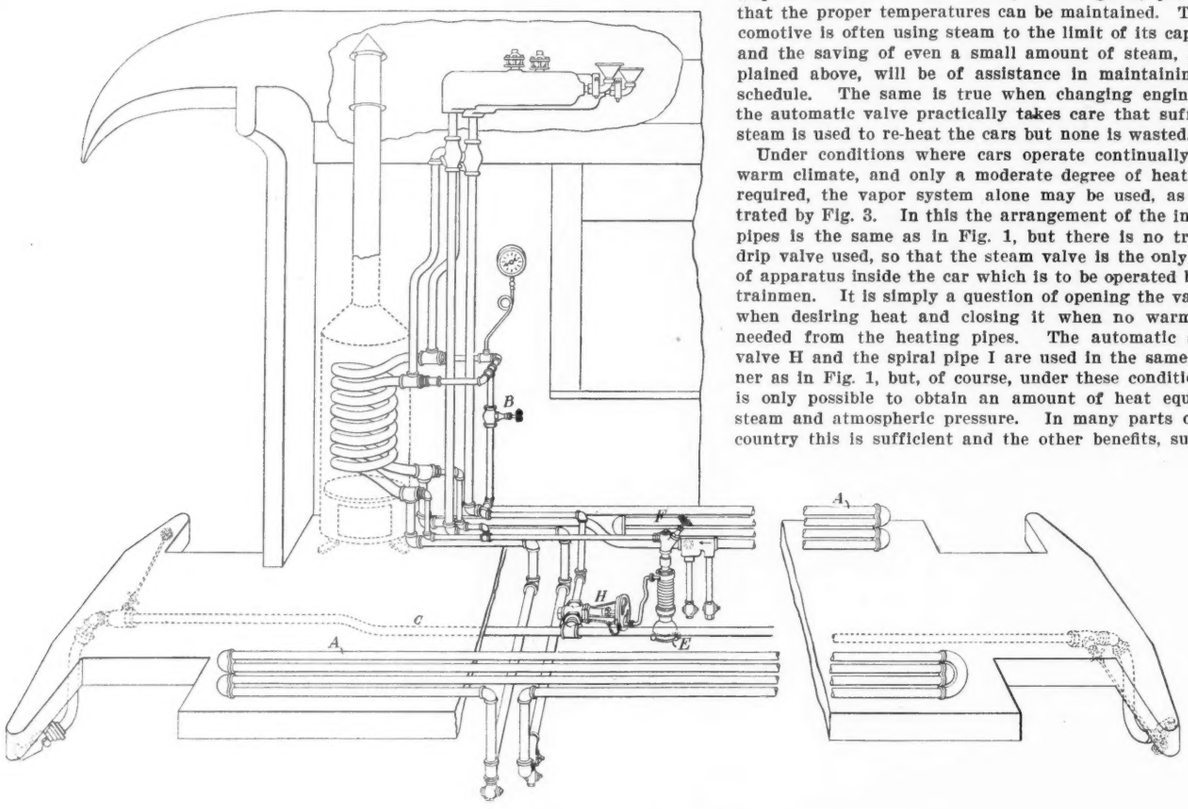


Fig. 4—Combination Vapor and Pressure System for Hot Water Use.

There are conditions under which the use of a heater and hot water system are advisable, so that should the car be detached from the engine for any length of time, a coal fire may be started in the heater, thus maintaining the temperature of the interior. The combination vapor and pressure system is also applicable to the hot water system and the arrangement is illustrated by Fig. 4. In this case steam is admitted from the train line C into the interior pipes of the double coils in the heater or stove by means of the valve B, the drip from the two coils being united and discharged from the car through the vertical trap E. Under the ordinary means of working with the valve F closed, there would be the same pressure in the coil of the heater as in the train pipe, but by opening the valve F, communication with the atmosphere is established and the pressure immediately falls to that of the atmosphere and the temperature of the steam is reduced accordingly. The automatic valve then comes into operation and maintains a low temperature steam supply in the interior coil or the heater, thus reducing the temperature of the circulating water in the pipes A. The regular connections to expansion drum, etc., are shown as ordinarily applied to hot water heating system, and it is again seen that no alteration of the interior piping of the car is necessary in order to change the single temperature system to the combination pressure and vapor system.

ANNUAL REPORT

TWELFTH ANNUAL REPORT OF THE NORTHERN PACIFIC RAILWAY COMPANY, FOR THE FISCAL YEAR ENDING JUNE 30, 1908.

To the Stockholders of the Northern Pacific Railway Company:

The following being the twelfth annual report, shows the result of the operation of your property for the fiscal year ending June 30, 1908:

Income Account.

	1907.	1908.	Increase or *decrease.*
Rev. from transportation:			
Freight	$47,650,369.73	$46,423,836.33	*$1,226,533.40*
Passenger	16,320,861.23	18,133,238.52	1,812,377.29
Other rev., transportation.	3,002,968.07	3,124,314.81	121,346.74
Totals	$66,974,199.03	$67,681,389.66	$707,190.63
Rev. from operation other than transportation	491,435.68	554,094.51	62,658.83
Total operating revenue.	$67,465,634.71	$68,235,484.17	$769,849.46
Per mile (average)	$12,393.41	$12,112.82	*$280.59*
Operating expenses:			
Maint. way & structures.	9,331,395.61	8,984,355.86	*$47,039.75*
Maint. of equipment	5,778,945.30	8,436,766.89	2,657,821.59
Traffic expenses	734,653.79	808,447.56	73,793.77
Transportation expenses.	19,901,787.54	20,743,429.22	841,641.68
General expenses	974,429.44	892,033.77	*82,395.67*
Totals	$36,721,211.68	$39,865,033.30	$3,143,821.62
Per mile (average)	$6,745.67	$7,076.64	$330.97
Net operating revenue.	$30,744,423.03	$28,370,450.87	*$2,373,972.16*
Per mile (average)	5,647.74	5,036.18	*611.56*
Outside operations:			
Sleeping, parlor, observation, dining and cafe cars and restaurants	530,569.40	640,925.86	$110,356.46
Total net revenue.	$31,274,992.43	$29,011,376.73	*$2,263,615.70*
Taxes accrued	2,398,719.00	2,717,485.67	318,766.67
Per mile (average)	440.64	482.39	41.75
Operating income	28,876,273.43	26,293,891.06	*2,582,382.37*
Other income:			
Dividends and interest on securities, interest on deposits and rentals received	2,876,798.61	4,003,998.21	1,127,199.60
Gross income	$31,753,072.04	$30,297,889.27	*$1,455,182.77*
Deduct:			
Hire of equipment	$879,256.24	Cr.$103,491.23	*$982,747.47*
Rentals paid	245,539.16	302,522.13	56,982.97
Interest on funded debt	6,994,620.01	7,098,907.50	104,287.49
Interest and commissions on new stock subscriptions	159,727.20	3,106,882.75	2,947,155.55
Dividends on stock	10,850,000.00	10,850,000.00	.....
Totals	$19,129,142.61	$21,254,821.15	$2,125,678.54
Net income for the year.	$12,623,929.43	$9,043,068.12	*$3,580,861.31*
Less amount appropriated for depreciation of equipment	$5,926,753.00	.....	*$5,926,753.00*
Less amount appropriated for insurance fund	.....	$2,784,950.28	2,784,950.28
Net surplus for the year.	$6,697,176.43	$6,258,117.84	*$439,058.59*
Ratio of operat'g expenses to total operating revenue, per cent.	54.43	58.42	3.99
Ratio of taxes to total operating rev., per cent.	3.56	3.98	.42

NOTE.—This income account, and its ancillary statements herein, have been prepared in accordance with the classifications promulgated by the Interstate Commerce Commission as of July 1, 1907, the accounts for the previous year having been recast for the purpose of comparison. Decreases are shown in *italics.*

Mileage Operated.

Changes have taken taken place in the mileage operated during the year as follows:

There were added:	Miles.
Bay Front Line in Superior, Wis., constructed	.68
Lake Park to Hawley, Minn., constructed	12.85
Lapwai Branch, extended Cul de sac to Vollmer, Idaho	23.05
Washington & Columbia River Railway, acquired	167.65
Tunnel line in Seattle, Wash., constructed	2.26
Total additions	206.49
Deductions:	
Red Lake Falls Branch, Minn., transferred to sidings	.64
Main line in Washington, transferred to yard tracks	4.75
Corrections by rechaining	.29
Total deductions	5.68
Net additions	200.81
Mileage operated June 30, 1907	5,448.32
Mileage operated June 30, 1908	5,649.13
Average mileage operated during the year	5,633.33

Earnings.

Freight Business.

Freight revenue was $46,423,836.33, a decrease of $1,226,533.40, or 2.57 per cent. from the previous year.

5,156,378,369 tons of revenue freight were moved one mile, a decrease of 348,065,729 tons one mile, or 6.32 per cent. from the previous year.

The rate per ton per mile increased from .00866 to .00900. This increase was due to a decrease in the proportion of lumber and other low class freight moved last year as compared with the previous year.

The revenue train load increased from 407.48 to 430.87 tons.

Passenger Business.

Passenger revenue was $18,133,238.52, an increase of $1,812,377.29, or 11.10 per cent. over the previous year.

Mail revenue was $995,320.42, a decrease of $42,735.68, or 4.12 per cent.

Express revenue was $1,280,619.43, an increase of $50,855.32, or 4.14 per cent.

Excess baggage and miscellaneous passenger revenue was $265,036.40, an increase of $49,153.31, or 22.77 per cent.

The total revenue for persons and property carried on passenger trains was $20,674,214.77, an increase of $1,869,650.24, or 9.94 per cent. over the previous year.

The number of passengers carried was 7,880,333, an increase of 926,909 over the previous year, and the number of passengers carried one mile was 794,351,948, an increase of 71,606,689, or 9.91 per cent.

The miles run by revenue passenger trains were 9,061,828, an increase of 160,839, or 1.81 per cent.

The rate per passenger per mile was .02283 and .02258 last year.

Operating Expenses.

Maintenance of Equipment.

The charges for maintenance of equipment were $8,436,766.89, an increase of $2,657,821.59, or 45.99 per cent. The increase was due to monthly charges for depreciation of equipment made in accordance with the rules of the Interstate Commerce Commission, amounting for the year, as shown below, to $2,727,615.30.

Locomotives.

Total number of engines on active list June 30, 1907		1,255
Additions:		
Purchased (or acquired):		
Pacific type passenger locomotives	10	
Mallet compound freight locomotives	16	
Consolidation freight locomotives	2	
Ten-wheel freight locomotives	3	
Eight-wheel freight locomotives	2	
Heisler geared freight locomotive	1	
Four coupled and trailer switch locomotive	1	
Six-wheel switch locomotives	25	
		60
		1,315
Deductions:		
Sold		1
Total number on active list June 30, 1908.		1,314

In addition to one locomotive from active list there were seven locomotives sold or scrapped from the superannuated list, leaving thirty still on that list.

Hauling Capacity.

The capacity of all engines on the active list as compared with last year is shown approximately by the following statement of total weights:

	Number.	Total Weight on Drivers.	Total Weight of Engines.
Assignment June 30, 1907	1,255	163,924,173	218,645,787
Added during fiscal year	60	11,046,100	12,622,200
	1,315	174,970,273	231,267,987
Sold during the fiscal year	1	71,550	71,550
Assignment June 30, 1908	1,314	174,898,723	231,196,437
Net increase	59	10,974,550	12,550,650
Percentage of increase	4.70%	6.69%	5.74%

Passenger Equipment.

On June 30, 1907, the company owned 893 passenger train cars, including 103 sleeping cars owned jointly with the Pullman Company; on June 30, 1908, 923 passenger train cars, including 103 sleeping cars owned jointly with the Pullman Company, a net increase of 30.

Freight Equipment.

Comparative number and capacity of freight cars:

	1907		1908		Increase or Decrease	
	Number	Capacity (Tons)	Number	Capacity (Tons)	Nbr.	Capcty. (Tons)
Box	25,010	855,118	24,480	848,719	*530*	*6,399*
Furniture	493	12,395	465	11,725	*28*	*670*
Refrigerator	891	22,680	953	23,655	62	975
Fruit	....	.....	....	.....	....	....
Stock	2,254	59,465	2,192	52,825	*62*	*6,640*
Flat	8,747	285,070	8,442	276,890	*305*	*8,180*
Oil	77	1,310	12	330	*65*	*980*
Coal	3,989	152,210	4,777	190,955	788	38,745
Ballast and Ore	859	34,255	850	34,000	*9*	*255*
Totals	42,320	1,422,503	42,171	1,439,099	*149*	16,596
Percentage	....	.....	....	.....	*.35%*	1.17%
Average capacity per car	....	33.6	....	34.1	....	.5

NOTE.—Figures in italics denote decrease.

In addition to equipment shown as on hand June 30, 1908, the following are due and will be received by the end of the year:

Passenger train cars	30
Freight train cars	1,013
	1,043

Depreciation of Equipment.

In accordance with the rules of the Interstate Commerce Commission, promulgated July 1, 1907, the following amounts have been charged to operating expenses on account of estimated depreciation of equipment, viz.:

Maintenance of way and structures:		
Work cars		$46,069.06
Maintenance of equipment:		
Locomotives	$852,784.76	
Passenger cars	312,075.25	
Freight cars	1,554,938.73	
Floating equipment	7,816.56	
		2,727,615.30
		$2,773,684.36

Maintenance of Way and Structures.

The charges for maintenance of way and structures were $8,984,355.86, a decrease of $347,039.75, or 3.72 per cent.

The property was well maintained and improved, as shown by the following:

Permanent Way.

New main line laid with 85-lb. rail	15.58 miles
New second track laid with 85-lb. rail	70.24 "
Main line relaid with new 85-lb. rail	218.19 "
Second track relaid with new 90-lb. rail	13.17 "
Second track relaid with new 85-lb. rail	18.16 "
Sidings and spur tracks constructed	145.94 "
Track ballasted	208.01 "
Embankment widened	70.10 "
Cross tie renewals, main line	1,801,728 ties
Cross tie renewals, branch lines	907.949 "
Timber bridges replaced by permanent structures and embankments, 79 in number, equal to	2.3 miles
Timber bridges renewed	84
Timber culverts replaced in permanent form	258
New stock fence constructed	119.7 miles
New snow fence constructed	23.0 "

Bridges.

During the year 163 bridges were replaced and 7 eliminated by lines changed and abandoned; 84 were replaced by timber structures, and 8 permanent and 71 timber structures were replaced in permanent form.

	Bridges.	Lineal ft.	
Replaced by embankment	61	11,094	
Replaced by plate girder and I-beams	18	1,049	
Total	79	12,143	= 2.30 miles

84 timber bridges, 11,285 lineal ft. have been renewed.

280 timber culverts were rebuilt, 22 in temporary and 258 in permanent form.

There are now under construction on operated lines 10 steel bridges.

The large steel viaduct at Valley City, N. Dak., has been completed except painting, and has been put into operation.

The two large draw spans over the St. Louis River at Duluth have been put into operation. There still remain two end piers to be placed under these spans, it being necessary to do this work during the closed season of navigation.

Bridges as They Exist June 30, 1908.

	No.	Aggregate length. Lin. ft.	Miles.
Steel, iron and stone permanent bridges	492	66,291	12.55
Timber and combination iron and timber struct.	2,711	421,762	79.88
Totals	3,203	488,053	92.43

The total length of timber structures replaced by steel bridges, embankment, or in other permanent form, from July 1, 1885, when the work was commenced, to June 30, 1908, has been 111.10 miles.

Buildings.

Brainerd, Minnesota—

New shop buildings and additions to present shop buildings were completed February, 1908, as follows:

Brick lavatory.
Two-story brick machine shop.
Brick boiler house.
Brick coal shed.
Brick storehouse and platform.
Additions to blacksmith shop.
The installation of additional machinery in these shops has also been completed.

Superior, Wisconsin—

A brick passenger depot at Nettleton avenue is now being built and will be finished this autumn.

St. Paul, Minnesota—

A two-story brick freight house and office building, 48 x 460 ft., in rear of the general office building, the first floor being used as a local freight house and office, the second floor as general offices, was completed during the autumn of 1907.

Staples, Minnesota—

Stockyards and barn with water supply have been constructed, which will facilitate the handling of stock to St. Paul and Chicago.

Detroit, Minnesota—

A brick passenger depot with platforms and crossings will be completed this autumn.

Dilworth, Minnesota—

The new division terminal buildings have been completed and put into service.

Dickinson, North Dakota—

A brick passenger depot has been erected and is in use.

Billings, Montana—

A brick passenger depot and brick lunch buildings are under construction and will be completed early in 1909.

Laurel, Montana—

A forty-stall roundhouse, shops and other division terminal buildings are being erected and will be ready for operation by October 15, 1908

Livingston, Montana—

New shop buildings and additions to present shop buildings have been completed as follows:

Power house.
Transfer pit.
Tool room.
Addition to machine shop, including installation of necessary tools.

Garrison, Montana—

A frame passenger station was completed during the year and will be put into operation as soon as double track and grade revision work between Garrison and Missoula is completed.

Pasco, Washington—

A frame lunch building is being erected at this station.

Lewiston, Idaho—

A brick passenger depot is under construction.

South Tacoma, Washington—

New shop buildings and extensions have been completed as follows:

Brick blacksmith shop.
Brick coal and iron store house.
Addition to transfer table pit.
Brick addition to machine shop.

Round Houses.

Additions to round houses have been completed as follows:

Mandan, North Dakota, 8 stalls.
Dickinson, North Dakota, 10 stalls.
Glendive, Montana, 13 stalls.
Forsythe, Montana, 8 stalls.
Livingston, Montana, 11 stalls.
Helena, Montana, 14 stalls.
Missoula, Montana, 19 stalls (frame).
Pasco, Washington, 7 stalls (frame).
Ellensburg, Washington, 10 stalls.

New hot air heating plants have been installed in round houses at:

Jamestown, North Dakota.
Mandan, North Dakota.
Dickinson, North Dakota.
Helena, Montana.

Coal Docks.

New three-track coal docks have been completed at:

Staples, Minnesota.
Lake Park, Minnesota.
Brackett, North Dakota.
Beach, North Dakota.
Custer, Montana.
Missoula, Montana.
Garrison, Montana.

Yards.

Duluth, Minnesota—

Filling between Docks 1 and 2 and Elevators "B," "C," and "D" to provide space for additional trackage, has been completed.

Dilworth, Minnesota—

The extensive new yards at this point have been completed and placed in service.

Laurel, Montana—

The grading for the new division terminal yards at this point has been completed and tracks are being laid, and this terminal will be ready for use by October 15, 1908.

Paradise, Montana and Sand Point, Idaho—

New yards, roundhouses and other terminal facilities are now being constructed at these two points and will be ready for use when line changes and grade revisions are completed between Spokane and Garrison, about February 1, 1909.

Interlocking Plants.

Fargo, North Dakota—

A mechanical interlocking plant has been installed at this point at crossing of the Northern Pacific, Great Northern and Chicago, Milwaukee & St. Paul Railways.

Water Supply.

Staples, Minnesota—

A 10-in. pipe line for water supply, extending from Dower Lake, was completed during the season of 1907.

Dilworth, Minnesota—

A plant for the softening of water for boiler use was installed at this point during the fiscal year.

Mile Post 45 West of Fargo, North Dakota (near)—

A storage reservoir was constructed, which with tank and pumping plant installed, are now in use.

Sterling, North Dakota—

A storage reservoir, pipe line, tank and pumping plant were completed and put into operation.

Mandan, North Dakota—

Storage reservoirs have been constructed on the bank of the Missouri River north of Mandan, with pumping station at river and pipe line to Mandan.

Tie Treating Plants.

The tie preserving plant at Brainerd, Minnesota, was in operation during the year, and up to June 30, 1908, 308,549 ties were treated.

A similar plant was completed at Paradise, Montana, during the year, and up to June 30, 1908, 208,916 ties were treated. The two plants have a capacity of 54,000 ties per week.

Charges to Capital Account.

Upon requisition of the executive officers, approved by the board of directors, expenditures have been made during the past fiscal year for:

Real estate, right of way and terminals:		
At Superior, Wis., real estate	$104,316.60	
St. Paul, Minn., real estate	271,738.14	
Como, Minn., real estate	56,987.55	
Minneapolis, Minn., real estate	248,481.19	
Paradise, Mont., real estate	11,685.90	
Spokane, Wash., real estate	9,717.54	
Seattle, Wash., real estate	10,572.00	
Tacoma, Wash., real estate	446,777.68	
South Tacoma, Wash., real estate	17,500.00	
Bellingham, Wash., real estate	91,616.41	
Dilworth, Minn., terminals, etc.	110,401.82	
Laurel, Mont., terminals, etc.	329,282.34	
Paradise, Mont., terminals, etc.	351.07	
Sand Point, Idaho, terminals, etc.	477.46	
Seattle, Wash., terminals, tunnel and passenger station	349,083.92	
Seattle, Wash., filling tide lands, improvements, etc.	7,457.48	
Sundry items	407.30	
		$2,060,854.40
Branches, line changes, grade revisions and second main track:		
St. Regis to Paradise, Mont., new line	$1,641,723.05	
White Pine Hill, Mont., grade revision	1,942,834.97	
Tacoma-Tenino Line, Wash.	217,293.51	
Gray's Harbor & Columbia Riv. Ry. Wash.	84,937.54	
Tacoma Tide Flats Branch, Wash.	11,641.52	
Sundry surveys and line changes	7,638.87	
Superior to Central Avenue, Wis., second main track	241,157.27	
Wadena Junction to Lake Park, Minn., second main track	182,441.84	
Lake Park to Glyndon, Minn., second main track	803,131.85	
Glyndon to Moorhead, Minn., second main track	1,926.89	
Haggart to Casselton, N. Dak., second main track	3,287.20	
Casselton to Wheatland, N. Dak., second main track	74,538.00	
Wheatland to Buffalo, N. Dak., second main track	54,807.80	
Alta to Berea, N. Dak., second main track	964,299.56	
Livingston to Muir, Mont., second main track	620,648.56	
West End to Bozeman, Mont., second main track	263,903.05	
Garrison to Missoula, Mont., second main track	3,193,951.07	
Auburn to Meeker, Wash., second main track	101,676.39	
Vancouver to Kalama, Wash., second main track	953,070.32	
		11,364,909.26
Additions and betterments:		
Right of way	$22,909.71	
Change of line and grade	90,254.33	
Widening embankment, ballast, etc.	106,842.94	
Increase in weight of rails and fastenings	164,741.51	
Spur tracks	73,881.12	
Passing tracks	277,806.60	
Sidings, wyes and crossovers	136,014.77	
Yards and terminals	389,721.25	
Interlocking and other signals	18,283.30	
Telegraph and telephone lines	41,866.43	
Bridges, trestles and culverts	754,181.85	
Right of way fencing	16,884.06	
Snow fences and sheds	1,151.37	
Cattle guards, crossings, etc.	17,009.91	
Passenger depots	49,612.99	
Freight houses and appliances	67,526.87	
Other station houses and stockyards	55,037.28	
Docks, wharves and coal bunkers	23,215.41	
Fuel and water stations	219,276.68	
Machinery dept. buildings and facilities	855,339.90	
Miscellaneous structures	173,207.22	
		3,554,765.50
Purchase of Washington & Columbia River Railway		5,067,040.33
New equipment:		
Locomotives	$975,060.38	
Passenger cars	247,872.14	
Freight cars	1,032,170.30	
		2,255,102.82
Total for the year		$24,302,672.31

In addition to the above amount added to the cost of the Northern Pacific estate, advances have been made to sundry companies, as follows:

Spokane, Portland & Seattle Railway Co	$9,418,975.41
Clearwater Short Line Railway Co	1,132,035.93
Big Fork & International Falls Railway Co	371,046.75
Total	$10,922,058.09

Capital Stock and Debt.

There was no change in the capital stock of the company during the year.

The amount received on subscriptions to new capital stock authorized, as explained in the last annual report, was, on June 30, 1908	$62,881,835.97
As shown by statement in the report of the comptroller, the bonded debt of the company increased	3,536,363.32

Washington & Columbia River Railway Company.

As explained in the report for the year ending June 30, 1907, all of the property of this company was sold on July 1, 1907, to the Northern Pacific Railway Company and the first mortgage bonds of $2,620,000 assumed by the latter company. Since then $2,197,000 of these bonds have been purchased.

This road is 167.65 miles long in a very fine wheat country in Southeastern Washington and Northeastern Oregon. The cost to your company, including the $2,620,000 of first mortgage bonds assumed, was $5,067,040.33.

Big Fork & International Falls Railway Company.

This road, which was under construction at the beginning of the fiscal year, has been completed and is now in operation. It extends from the end of the Minnesota International Railway at Big Fork to International Falls, Minnesota, 34.01 miles. Owing to the business depression the development of the water power and the building of pulp, paper and lumber mills at the latter place has been delayed, but the prospects for the resumption of work on the power plant are good.

The Northern Pacific Railway Company has advanced for the construction of this road $682,190.92.

Joint Lines with the Union Pacific Railway Company.

The road mentioned in the last annual report, between Texas Ferry, Washington, on the Snake River, and Grangeville, Idaho, is still under construction.

The road between Texas Ferry and Lewiston, Idaho, which is being built under the direction of the Union Pacific Railroad Company was finished to a connection with the road of the Northern Pacific Railway Company near Lewiston during the year. The necessary arrangements for joint station facilities at Lewiston are now being made and will be completed shortly.

The road between Cul de sac and Grangeville, Idaho, is being constructed under the direction of the Northern Pacific Railway Company. From Cul de sac to Vollmer, Idaho, 23.05 miles were completed during the fiscal year. Track has been laid from this point to Lawyer's Canyon, 27.12 miles. At this point there is a steel viaduct 1,489 ft. long and 286 ft. high. The erection of this large viaduct has been very slow owing to a large amount of stormy weather, but it is now finished and the road should be completed to Grangeville by November 1, 1908.

Spokane, Portland & Seattle Railway.

The road between Kennewick and Vancouver, Washington, 220.6 miles has been completed.

Work has continued on the lines east of the Columbia River. From Snake River Junction to Pasco, Washington, 26.09 miles, the grading and erection of wooden bridges is completed and track laid and about 15 miles ballasted.

From Snake River Junction to Spokane, 119.01 miles, grading is practically completed from the Junction to Cheney, Washington, and 38.90 miles of track laid. There also remains to be completed steel viaducts at Cow Creek and at Box, Wilson, Bouvey and Burr Canyons along the Snake River.

Between Snake River Junction and Riparia, 40.6 miles, all grading

has been completed and work on the few bridges, and track laying is now in progress.

All these lines should be completed this winter.

Vancouver-Willamette Bridges.

The bridges across the Columbia and Willamette Rivers and intermediate sloughs are practically completed, some work remaining to be done on the operating machinery.

Portland Terminals.

The two freight houses at Portland are completed. Work is under way on warehouse and tracks on the company's water front property on the Willamette River.

Double Track, Grade Revisions and Line Changes.

Wisconsin.

Central Avenue Wye to Fourth Street, Superior, 4.1 miles—

Second main track and revision of present grade, 0.75 per cent. to 0.5 per cent. west bound, begun in June, 1907, is completed.

Superior to Central Avenue, 3.9 miles—

Second main track begun in May, 1907, is completed.

Minnesota.

St. Paul to St. Cloud—

On the Great Northern Line from Northtown Junction to East St. Cloud, 61.65 miles, on which the Northern Pacific has secured trackage rights and which it took over for operation July 1, 1906, 20 miles of 90-pound rail and ballasting of the entire track has been authorized. Work is now under way and will be completed in the fall of 1908.

Wadena Junction to Lake Park, 54.8 miles—

The work of double tracking and revising grades on this part of the line, which was begun in April, 1906, was completed in the fall of 1907, with the exception of the grade revision of the old main line from Oak Lake to Audubon, which is under way and will be completed this autumn.

Lake Park to Glyndon, 26.83 miles—

Work of double tracking on new location begun in May, 1906, will be completed late in fall of 1908.

North Dakota.

Casselton to Wheatland, 6.06 miles—

This double track work which was begun in 1907 was completed in the fall of 1907.

Wheatland to Buffalo, 11.2 miles—

This grade revision, which was commenced in 1906, is nearing completion and will be finished in the fall of 1908. Part of the surplus material taken from the cut was used in revising the east bound grade at mile post 38, two miles east of Buffalo. The remainder of the excavated material is being used in making grade for

Alta to Berea, 9.40 miles—

This new line, which runs north of Valley City, N. D., was completed for freight operation in May, 1908. The entire work will be finished early in the fall of 1908. The maximum grade on new line is 0.3 per cent. in each direction. The present line through Valley City with grades of 1 per cent. east and 1.2 per cent. west bound will be continued in operation for local freight business.

This work will complete the revision of grades between Berea, North Dakota, and Staples, Minnesota, to three-tenths grade eastbound and four-tenths west-bound, with the exception of the helper grade from Oriska to Alta, a distance of 4.5 miles.

Montana.

Livingston to Muir, 11.5 miles—

The grade revision and double track work between Livingston and the east end of the tunnel on the Bozeman Mountain has been completed with the exception of the tunnel, the walls of which have been lined and it is expected to complete the roof by early autumn. Distance is reduced 1,142 ft. and curvatures 642 degrees, west bound grade reduced from 2.2 per cent. to 1.8 per cent. and maximum curves from 8 deg. to 3 deg.

West End to Bozeman, 11.8 miles—

The second track parallel to present main line has been completed.

Garrison to Missoula, 69.1 miles—

Grade revision and second track work. The heavy floods in Montana during the first week of June, 1908, did much damage to this work and will cause some delay in its completion.

To the end of the fiscal year 55.70 miles of main track had been laid and 2.54 miles of side track.

St. Regis to Paradise, 21.8 miles—

Grading is practically completed and track has been laid for 10 miles out of St. Regis and will probably be completed by the 1st of December, 1908.

De Smet to St. Regis, 72.0 miles—

This work consists of revision and repairing of the Coeur d'Alene Branch from De Smet (6 miles west of Missoula) to St. Regis on a 0.5 per cent. grade line and present location. Work will be completed late this fall.

White Pine Hill, 28.4 miles, change of line and grade—

All grading is completed and track laid. Bridges and ballasting will be completed in October.

Grade revisions at Noxon, Heron and Cabinet hills have been completed.

Washington.

Auburn to Meeker, 7.5 miles—

This work is completed to a point about 0.2 miles east of the bridge across the Puyallup River about one mile from Meeker, and will be completed this fall.

Vancouver-Kalama second main track and revision, 29.9 miles—

All grading is completed except for some of the second track work. To date 24.9 miles of main track have been laid and ballasting is in progress.

During the fiscal year ending June 30, 1908, there were moved on important pieces of work under construction on the Northern Pacific road:

2,310,235 cu. yds. of earth,	
3,589,614 " " " hard pan, etc.,	
2,043,291 " " " solid rock.	
Total number of cu. yds. of material moved.....	7,943,140
On the Spokane, Portland & Seattle during the same period there were moved:	
7,982,118 cu. yds. of earth,	
7,039,767 " " " hard pan, etc.,	
6,469,042 " " " solid rock.	
Total number of cu. yds. of material moved.....	21,490,927
Grand total of material moved on construction work on the Northern Pacific and Spokane, Portland & Seattle Railways	29,434,067

General.

During the autumn of 1907 the volume of business offered to the company was in excess of its capacity in the district between Trout Creek, Montana, on the west, and Billings, Montana, on the east, and there was serious congestion and delay in handling business on this part of the road, which in turn caused delay east of Billings and west of Trout Creek. The construction work, which is approaching completion at various points between Billings and Spokane, will give a largely increased capacity to this part of the railroad.

During the latter part of May and early part of June there were very unusual rains in Central Montana which, with the melting snow from the mountains, raised the streams west of the Rocky Mountains to a level never before known. There were very serious washouts on both main line and branches from Helena and Butte west as far as Paradise, and also in the Clearwater Valley. There were also serious washouts east of Butte and Helena both in the valleys and on the Butte and Bozeman mountains. As a result no through trains were run between Butte and Helena and Spokane and west from May 31 to June 23. Part of this time the company withdrew from all through business. Part of the time its business was detoured over the Great Northern Railway and the Oregon Short Line.

On the 23d of September, 1907, the company was enjoined by the United States Circuit Court for the District of Minnesota, in a suit brought by Charles E. Perkins and David C. Shepard, stockholders, from putting into effect the tariffs provided by an act of the Legislature of Minnesota, approved April 18, 1907, reducing the company's rates upon grain, coal, lumber and livestock. The suit brought by Perkins and Shepard also prayed for an injunction restraining the company from complying with the Minnesota law fixing passenger rates at two cents a mile, and from complying with the order of the Railroad and Warehouse Commission of Minnesota, reducing the company's rates upon merchandise. The company had complied with the passenger rate law and with the Railroad Commission's order before Perkins and Shepard brought their suit. Because of such compliance the Circuit Court declined to issue a temporary injunction as to those rates. The suit is now in process of determination upon its merits and involves the legality of the two state laws and of the Railroad Commission's order referred to above.

More than thirty days prior to November 1, 1907, the company filed and posted a tariff to become effective on that date, raising the rates upon lumber and shingles from points of production in Montana, Idaho, Washington and Oregon, to St. Paul, Minneapolis and Duluth and to Missouri River points. This new tariff proposed to increase the rates on fir lumber from the Pacific coast to St. Paul from 40 cents to 50 cents per hundred pounds; and to Omaha and other Missouri River points from 50 cents to 55 cents per hundred pounds; and to increase the rate on shingles to St. Paul from 50 cents to 60 cents per hundred pounds, and to Omaha and other Missouri River points from 60 cents to 65 cents per hundred pounds.

Complaints against these proposed rates were filed by western lumbermen with the Interstate Commerce Commission. After a lengthy trial the Commission fixed, to become effective October 15, 1908, the following as the maximum rates to continue for two years:

Pacific coast to St. Paul, fir lumber.....	45c. per 100 lbs.
Pacific coast to St. Paul, shingles.....	55c. per 100 lbs.
Pacific coast to Omaha and other Missouri River points, fir lumber	50c. per 100 lbs.
Pacific coast to Omaha and other Missouri River points, shingles	60c. per 100 lbs.

This company, believing that the rates fixed by the Commission are unjustly low, has begun a suit in the Circuit Court of the United States for the District of Minnesota to enjoin the enforcement of the rates fixed by the Commission as stated above.

On July 1, 1907, the law passed by the state of North Dakota reducing passenger rates from three cents to two and one-half cents a mile became effective.

The Report of the Comptroller gives further details of the transactions of the company.

By order of the Board of Directors,

HOWARD ELLIOTT,
President.

Income Account for the Fiscal Year Ending June 30, 1908.

Dr.			Cr.		
To operating expenses:			By operating revenues:		
Maintenance of way and structures	$8,984,355.86		Freight	$46,423,836.33	
Maintenance of equipment	8,436,766.89		Passenger	18,133,238.52	
Traffic expenses	808,447.56		Other	3,678,409.32	
Transportation expenses	20,743,429.22				$68,235,484.17
General expenses	892,033.77		Outside operations:		
		$39,865,033.30	Sleeping cars	$417,266.18	
Taxes:			Parlor and observation cars	83,441.05	
State and county		2,717,485.67	Dining and cafe cars	54,866.74	
Interest and rentals:			Restaurants	85,351.89	
Interest on funded debt	$7,098,907.50				640,925.86
Interest and commission on new stock subscriptions	3,106,882.75		Rentals received		984,842.49
Rentals of leased roads and terminals	301,343.56		Miscellaneous income		5,531.18
Other rentals	1,178,57		Dividends and interest on securities owned and interest on deposits		3,117,115.77
		10,508,312.38			
Dividends:					$72,983,899.47
Nos. 40, 41, 42 and 43		10,850,000.00			
Appropriation for insurance fund		2,784,950.28			
Balance carried to credit of profit and loss below		6,258,117.84			
		$72,983,899.47			

Profit and Loss Account, June 30, 1908.

To Balance of sundry accounts written off	$242,460.34	By balance to credit June 30, 1907, as per annual report	$44,595,707.03
Balance	50,611,364.53	Balance of income for year ending June 30, 1908, brought down	6,258,117.84
	$50,853,824.87		$50,853,824.87
		By balance to credit of profit and loss, per balance sheet	$50,611,364.53

Northern Pacific Railway Company—General Balance Sheet, June 30, 1908.

Capital Assets.

Northern Pacific estate:			
Balance of this account June 30, 1907			$311,575,980.51
To which add:			
New mileage, grade revisions and second track constructed since	$11,364,909.26		
Cost of Washington & Columbia Riv. Railway (exclusive of equipment)	4,975,915.33		
Rl. est. and terminals purchsd. since	2,060,854.40		
Additions and betterments since	3,554,765.50		
		21,956,444.49	
		$333,532,425.00	
Less:			
Net proceeds of land department	$1,039,809.66		
Sale of sundry property	165,374.46		
		1,205,184.12	
		$332,327,240.88	
Equipment:			
Balance of this acct. June 30, 1907	$37,138,636.07		
New equipm't purchsd. or built since	2,255,102.82		
Wash. & Col. Riv. Ry. equip. purchsd.	91,125.00		
		39,484,863.89	
Property leased to Province of Manitoba:			
Value of road and appurtenances	$6,812,512.94		
Value of equipment	157,034.00		
Value of material and supplies	30,453.06		
		7,000,000.00	
Cash in hands of trustees of sinking funds		984,055.36	
Securities in hands of trustee of St. Paul-Duluth Div. bonds as collateral		1,352,847.33	
Cost of securities in hands of trustee of Northern Pacific-Great Northern joint bonds as collateral (1,076,130 shares C., B. & Q. R. R. capital stock—Northern Pacific Railway Company one-half owner)		109,114,309.76	
Total		$490,263,317.22	

Current Assets.

Cash assets:			
Cash on hand and in banks			$34,900,794.91
Accounts receivable	$6,908,679.41		
Bills receivable	191,118.18		
		7,099,797.59	
Material on hand		6,113,388.17	
Treasury securities:			
$983,000 No. Pac. Ry. gen. lien bonds	$733,398.11		
1,552,000 No. Pac. Ry. prior lien bonds	1,553,471.54		
2,154,000 N. Pac.-Gt. Nor. joint bonds	2,119,994.12		
361,000 St. Paul-Duluth Div. bonds	361,000.00		
7,000,000 Northw'n Impvt. Co. bonds	7,000,000.00		
2,775,000 Northw'n Impvt. Co. stock	2,775,000.00		
315,000 Wash. Central Ry. bonds	291,375.00		
1,000,000 Wash. Central Ry. stock	221,279.94		
2,127,200 Clearwater Short Line Ry. stock	2,127,200.00		
71,800 Lake Sup. T. & T. Ry. stock	32,001.00		
59,850 St. Paul Union Depot Co. stock	59,850.00		
		17,274,569.71	
Construction advances to railway cos.:			
Spokane, Portland & Seattle Ry. Co.	$26,514,893.28		
Clearwater Short Line—joint line	3,366,414.50		
Big Fork & Internat'l Falls Ry. Co.	682,190.92		
		30,563,498.70	
Insurance fund assets:			
Cash, bonds, etc.		5,000,000.00	
Land department:			
Balance of land dept. current assets		2,365,196.96	
Total		$103,317,246.04	
		$593,580,563.26	

Capital Liabilities.

Capital stock:			
Common stock			$155,000,000.00
Subscription receipts issued for new capital stock			62,881,835.97
Mortgage debt:			
Prior lien bonds	$111,650,000.00		
Less bonds canceled	4,665,500.00		
		$106,984,500.00	
General lien bonds		60,000,000.00	
St. P.-Dul. Div. bonds	$10,241,000.00		
Less bonds canceled	2,339,000.00		
		7,902,000.00	
N. Pac.-Gr. Nor. joint bonds—total issue	$215,226,000.00		
Less Gr. Nor. Ry. Co.'s proportion	107,613,000.00		
		107,613,000.00	
			282,499,500.00
Capital liabilities issued			$500,381,335.97
Indebtedness of other companies assumed by Northern Pacific Railway Co.:			
St. Paul & Northern Pacific Ry. Co. general mortgage bonds		$8,021,000.00	
St. Paul & Duluth R. R. 1st mort. bonds		1,000,000.00	
St. Paul & Duluth R. R. 2d mort. bonds		2,000,000.00	
St. Paul & Duluth R. R. first consolidated mortgage bonds		1,000,000.00	
Taylor's Falls & Lake Superior R. R. bonds (guaranteed by St. Paul & Duluth Railroad Co.)		210,000.00	
Duluth Short Line Ry. bonds (guaranteed by St. P. & Dul. R. R. Co.		500,000.00	
Wash. & Col. Riv. Ry. 1st mort. bonds		2,620,000.00	
St. P. & Duluth R. R. car trust notes		2,239.32	
Capital liabilities assumed			15,353,239.32
Total			$515,734,575.29

Current Liabilities.

Payrolls, vouchers and miscel. accounts		$6,375,720.02	
Taxes accrued on railway (partly est'd)		1,955,409.41	
Interest on mortgage debt:			
Accrued	$536,786.66		
Matured, including interest due July 1, 1908	1,170,825.75		
		1,707,612.41	
Dividends unpaid:			
Common stock dividend No. 43, due August 1, 1908	$2,712,500.00		
Unpaid dividends St. P. & Duluth R. R. Co.	1,854.50		
		2,714,354.50	
Reserve accounts:			
For improvements and replacement of equipment, etc.		9,416,028.23	
Total			22,169,124.57

Contingent Liabilities.

Insurance fund account	$5,000,000.00	
Liquidation account:		
Reserve for possible liabilities in connection with purchase of Northern Pacific R. R. Co. and St. Paul & Duluth R. R. Co.	65,498.87	
Total		5,065,498.87

Profit and Loss.

Balance June 30, 1908, as per statement	50,611,364.53
	$593,580,563.26

MORTGAGE DEBT JUNE 30, 1908.

Name.	Amount outstanding.	Interest— Date.	Matures.	Rate.	When payable.	Amount charged income for fiscal year.*
Issued:						
Northern Pacific Ry. Co. prior lien mortgage	$106,984,500.00	1897	1997	4 per cent.	Jan., April, July, Oct...	$4,207,250.00
Northern Pacific Ry. Co. general lien mortgage	60,000,000.00	1897	2047	3 "	Feb., May, Aug., Nov...	1,775,857.50
Northern Pacific Ry. Co., St. Paul-Duluth Div. mort.	7,902,000.00	1900	1996	4 "	June, December	302,140.00
Assumed:						
St. Paul & Northern Pacific Ry. mortgage	8,021,000.00	1883	1923	6 "	February, August †	481,260.00
St. Paul & Duluth R. R. first mortgage	1,000,000.00	1881	1931	5 "	February, August	50,000.00
St. Paul & Duluth R. R. second mortgage	2,000,000.00	1887	1917	5 "	April, October	100,000.00
St. Paul & Duluth R. R. first consolidated mortgage.	1,000,000.00	1898	1968	4 "	June, December	40,000.00
St. P. & Dul. R. R., Taylor's Falls & Lake Sup. mort.	210,000.00	1884	1914	6 "	January, July	12,600.00
St. Paul & Duluth R. R., Duluth Short Line mortgage	500,000.00	1886	1916	5 "	March, September	25,000.00
Washington & Columbia River Ry. first mortgage	2,620,000.00	1895	1935	4 "	January, July	104,800.00
Total	$190,237,500.00					$7,098,907.50
St. Paul & Duluth R. R. car trust note "C"	2,239.32	Payable December 15, 1908.				
Grand totals	$190,239,739.32					$7,098,907.50

NOTE.—The above is exclusive of the Northern Pacific-Great Northern joint bonds outstanding.

* Interest on $1,552,000 prior lien bonds, $361,000 St. Paul-Duluth Division bonds and $983,000 general lien bonds held as treasury securities, not included above.

† Registered interest payable quarterly.

PASSENGER, FREIGHT AND MISCELLANEOUS STATISTICS.

	1906-1907 Passengers, miles, tons, etc.	1906-1907 Amount, rate, etc.	1907-1908 Passengers, miles, tons, etc.	1907-1908 Amount, rate, etc.	Increase.	Per cent.	Decrease.
Average mileage for the year	5,443.67	.....	5,633.33	.....	.....	...	.....
Passenger traffic:							
Number of passengers carried	6,953,424	.....	7,880,333	.....	926,909	13.33	.....
Number of passengers carried one mile	722,745,259	.....	794,351,948	.....	71,606,689	9.91	.....
Avg. miles traveled by each passenger	103.9	.....	100.8	.....	.....	2.98	3.1
Passenger revenue	....	$16,320,861.23	.....	$18,133,238.52	$1,812,377.29	11.10	.....
Other passenger train revenue	....	2,483,703.30	.....	2,540,976.25	57,272.95	2.31	.....
Total passenger train revenue	....	18,804,564.53	.....	20,674,214.77	1,869,650.24	9.94	.....
Avg. amount paid by each passenger	....	2.35	.....	2.30	.....	2.13	.05
Avg. rate per passenger per mile	....	.02258	.....	.02283	.00025	1.11	.....
Pass. train rev. mile of road (avg. mlge.)	....	3,454.39	.....	3,669.98	215.59	6.24	.....
Freight traffic:							
No. tons revenue freight carried	16,741,470	.....	15,836,823	.....	.....	5.40	904,647
No. tons rev. freight carried one mile	5,504,444,098	.....	5,156,378,369	.....	.....	6.32	348,065,729
Average distance haul of one ton	328.8	.....	325.6	.....	.....	.97	3.2
Freight revenue	....	47,650,369.73	.....	46,423,836.33	.....	2.57	1,226,533.40
Other freight train revenue	....	519,264.77	.....	583,338.56	64,073.79	12.34	.....
Total freight train revenue	....	48,169,634.50	.....	47,007,174.89	.....	2.41	1,162,459.61
Avg. receipts from each ton of freight	....	2.85	.....	2.93	.08	2.81	.....
Avg. receipts ton per mile rev. freight	....	.00866	.....	.00900	.00034	3.93	.....
Frgt. train rev. mile of road (avg. mlge.)	....	8,848.74	.....	8,344.47	.....	5.70	$504.27
Total train traffic:							
Rev. from freight and passenger trains	....	66,974,199.03	.....	67,681,389.66	707,190.63	1.06	.....
Revenue per mile of road (average)	....	12,303.13	.....	12,014.45	.....	2.35	288.68
Revenue per train mile	....	2.99	.....	3.22	.23	7.69	.....
Expenses per train mile	....	1.64	.....	1.89	.25	15.24	.....
Net traffic revenue per train mile	....	1.35	.....	1.33	.....	1.48	.02
Train and car mileage:							
Mileage of revenue passenger trains	8,900,989	....	9,061,828	.....	160,839	1.81	.....
Mileage of locomotives employed in "helping" passenger trains	514,901	.....	504,804	.....	.....	1.96	10,097
Percent. "helping" to rev. train mil'ge	5.78	.....	5.57	.....	.....	...	.21
Mileage of revenue mixed trains	727,593	.....	852,340	.....	124,747	17.15	.....
Mileage of revenue freight trains	12,780,978	.....	11,115,133	.....	.....	13.03	1,665,845
Mileage of locomotives employed in "helping" mixed and freight trains.	2,843,368	.....	2,076,019	.....	.....	26.99	767,349
Percent. "helping" to rev. train mil'ge	21.05	.....	17.35	.....	.....	...	3.70
Mileage of revenue special trains	23,665	.....	11,697	.....	.....	50.57	11,968
Total revenue train mileage	22,433,225	.....	21,040,998	.....	.....	6.21	1,392,227
Mileage of non-revenue trains	2,434,324	.....	1,701,791	.....	.....	30.09	732,533
Mileage of passenger cars	62,518,019	.....	60,979,767	.....	.....	2.46	1,538,252
Avg. No. of passenger cars in train	6.49	.....	6.15	.....	.....	5.24	.34
Avg. number of passengers in train	75.06	.....	80.12	.....	5.06	6.74	.....
Avg. number of passengers in each car	11.56	.....	13.03	.....	1.47	12.72	.....
Mileage of loaded freight cars	309,277,780	.....	273,358,841	.....	.....	11.61	35,918,939
Mileage of empty freight cars	70,001,961	.....	64,978,992	.....	.....	7.18	5,022,969
Mileage of caboose cars	12,705,141	.....	11,205,528	.....	.....	11.80	1,499,613
Total mileage of revenue freight cars	391,984,882	.....	349,543,361	.....	.....	10.83	42,441,521
Special service car mileage, freight	234,662	.....	74,707	.....	.....	68.16	159,955
Special service car mileage, passenger	150,718	.....	53,153	.....	.....	64.73	97,565
Total special service car mileage	385,380	.....	127,860	.....	.....	66.82	257,520
Non-revenue service car mileage	4,614,759	.....	4,857,769	.....	243,010	5.27	.....
Avg. No. loaded freight cars in train	22.89	.....	22.84	.....	.....	.22	.05
Avg. No. empty freight cars in train	5.18	.....	5.43	.....	.25	4.83	.....
Average number freight cars in train (exclusive of cabooses)	28.07	.....	28.27	.....	.20	.71	.....
Percentage of empty cars to total cars in train (exclusive of cabooses)	18.45	.....	19.21	.....	.76	...	.....
Avg. No. tons rev. freight in train	407.48	.....	430.87	.....	23.39	5.74	.....
Average number tons revenue freight in each loaded car	17.80	.....	18.86	.....	1.06	5.96	.....
Company freight, tons carried	4,879,679	.....	4,583,856	.....	.....	6.06	295,823
Company freight, tons car'd one mile	1,156,210,616	.....	1,038,983,533	.....	.....	10.14	117,227,083
Tons per train, company & commercial	493.07	.....	517.68	.....	24.61	4.99	.....
Tons loaded car, company & commercial	21.54	.....	22.66	.....	1.12	5.20	.....

NOTE.—This statement has been prepared in accordance with the rules of the Interstate Commerce Commission, the items for the previous year being recast for purpose of comparison.